

Title: Changes to the Glass Packaging Recycling Business Target to 2017 IA No: DEFRA1534 Lead department or agency: Defra Other departments or agencies: Scottish Government, Welsh Assembly Government, Dept of the Environment Northern Ireland, HM Treasury	Impact Assessment (IA)		
	Date: 03/02/2014		
	Stage: Final		
	Source of intervention: EU		
	Type of measure: Secondary legislation		
Contact for enquiries: Sarah Steeds, 020 7238 4346			
Summary: Intervention and Options		RPC Opinion: Not Applicable	

Cost of Preferred (or more likely) Option			
Total Net Present Value	Business Net Present Value	Net cost to business per year (EANCB on 2009 prices)	In scope of One-In, Two-Out? Measure qualifies as
£2.23m	£-1.15m	£0.24m	No NA

What is the problem under consideration? Why is government intervention necessary?
The management and disposal of packaging waste produces environmental externalities such as greenhouse gas emissions and disamenity impacts from landfill, the full social cost of which is not taken into account in production or consumption decisions. Without intervention, there would be overproduction of packaging and insufficient levels of recycling. The EU sets mandatory packaging recycling targets. The UK complies through mandatory statutory recycling business targets, achieved through a producer responsibility system. By making packaging handlers and producers pay some of the costs of recycling packaging, these costs are internalised and lead to reduced environmental impacts and a more efficient outcome.

What are the policy objectives and the intended effects?
The policy objectives are to make adjustments to the market based system that the UK uses to meet the EU targets and internalise the costs of packaging for packaging producers. The adjustments are required because of new information on the flow of glass packaging and the discovery of fraud in previous years. This evidence has revealed that the business targets set for packaging producers had been set too high causing high costs and significant overachievement against the EU targets. The intended effect is to reduce costs for packaging producers and reduce the social costs associated with the current targets.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)
The consultation impact assessment considered 5 options:
Option 1 - Do Nothing - keep target at 81%; Option 2a - Reduce target to 75% which would deliver 62% recycling, above EU minimum.; Option 2b - reduce target to 75% and additionally amend the end use split to 35% aggregate to 65% remelt to reflect the reduction in aggregate in the market; Option 3a - Reduce target to 77% which would deliver 65% recycling, above EU minimum; Option 3b - Reduce target to 77% and amend split to 34%/66% to reflect the reduction in the aggregate market.
The preferred option, post consultation is to pursue an option of an incrementally increasing target rising from 75% in 2014, to 76% in 2015 and 77% in 2016 onwards, with an incrementally increasing remelt split 35%/65% in 2014, 34%/66% in 2015 and 33%/67% in 2017 as this option appropriately balances the needs of the different parts of the supply chain.

Will the policy be reviewed? It will be reviewed. If applicable, set review date: 04/2017					
Does implementation go beyond minimum EU requirements?			No		
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	Micro No	< 20 Yes/No	Small Yes/No	Medium Yes	Large Yes
What is the CO ₂ equivalent change in greenhouse gas emissions? (Million tonnes CO ₂ equivalent)			Traded: 0.09	Non-traded: 0.00	

I have read the Impact Assessment and I am satisfied that (a) it represents a fair and reasonable view of the expected costs, benefits and impact of the policy, and (b) that the benefits justify the costs.

Signed by the responsible SELECT SIGNATORY: _____ Date: _____

Summary: Analysis & Evidence

Policy Option 1

Description: Reduce glass business targets to 75%/76%/77%/77% for years 2014-17 and the split between remelt and other applications as 65/35; 66/34; 67/33; 67/33 for years 2014-17

FULL ECONOMIC ASSESSMENT

Price Base Year 2014	PV Base Year 2014	Time Period Years 4	Net Benefit (Present Value (PV)) (£m)		
			Low: -1.21	High: 5.66	Best Estimate: 2.23

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		
High	Optional		
Best Estimate		29.1	110.7

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

Costs to glass reprocessors and export businesses of no longer receiving PRN revenue £106.9m. Costs to MRFs and businesses in the supply chain of no longer receiving material revenue from recovered glass of £3.26m.

Costs to society of reduced avoided greenhouse gas emissions from a reduction in recycling of glass of £0.55m

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

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional	28.8	109.5
High	Optional	30.6	116.4
Best Estimate		29.7	112.9

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

Benefits to obligate packaging businesses of having to buy fewer PRNs and a reduction in the average PRN price of £106.9m.

Benefits to businesses of having to collect and pay for less glass for recycling and no longer having to divert it from landfill £2.11m (£0.91m - £3.31m). Benefits to local authorities of having to collect less glass for recycling and no longer having to divert it from landfill £3.92m (£1.69m - £6.16m)

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

Key assumptions/sensitivities/risks

Discount rate (%) 3.5%

The analysis assumes average collection and sorting costs and material prices over the next 4 years. A reduction in obligated tonnage is expected to lead to a reduction in PRN prices. This analysis is sensitive to changes in collection costs, the split between household and C&I collections, the traded carbon price and the level of material revenue.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			In scope of OITO?	Measure qualifies as
Costs: 22.7	Benefits: 22.5	Net: -0.2	No	NA

Executive Summary

The management and production of waste incurs environmental externalities such as greenhouse gas emissions and disamenity impacts from litter. The full social costs and benefits are not taken into account in production or disposal decisions, resulting in the over production of waste and sub optimal decisions on waste management options. A waste management system that internalises the environmental impacts in pricing of treatment options should result in a more efficient level of waste and allocation to different treatment options.

Decisions about the design and production of packaging are made without taking into account the costs of dealing with the discarded packaging at the point of consumption. This can lead to the over-production of packaging as the suppliers of packaging do not face the full costs of dealing with packaging waste. Further, there are environmental benefits of moving packaging waste up the waste hierarchy¹ at end of life that are not reflected in waste management costs and result in a sub-optimal mix of waste management. The waste hierarchy ranks different waste management options broadly according to their environmental impact. For example, shifting waste from landfill to recycling results in environmental benefits from avoided use of virgin materials and associated greenhouse gas impacts. Shifting waste further up the hierarchy to reuse would provide even greater environmental benefits from, for example, reduced reprocessing impacts.

The UK has had since 1997 a statutory producer responsibility scheme for packaging recycling, which implements the EU Packaging Directive. This scheme internalises some of the externalities of dealing with packaging at the end of its life. This reduces the amount of packaging waste going to landfill and reduces the associated environmental impacts. It does so by setting minimum recycling and recovery targets on UK businesses in the packaging supply chain. The current targets run from 1 January 2013 for five years.

In order to comply with the Packaging Directive, obligated packaging producers and handlers must demonstrate a minimum level of recovery and recycling has occurred by purchasing Packaging Waste Recovery Notes (PRNs). PRNs are issued by exporters or recyclers when a tonne of relevant packaging material has been recovered and is sold for reprocessing. This demand for PRNs from obligated producers creates a market for PRNs that can be issued by accredited domestic reprocessors and exporters of recovered material. The price for PRNs, although volatile, should reflect the marginal cost of meeting the obligation. Specifically, for each PRN it should reflect the additional cost of diverting material from landfill to recycling that is not covered by existing economic drivers. In this way obligated packaging producers and handlers internalise some of the cost of dealing with packaging at the end of its life. A very low PRN level would indicate that little additional incentive is required to deliver the level of recycling set by business targets.

Due to significant volatility in the glass recycling market in 2012, Defra tasked the Advisory Committee on Packaging (ACP) with investigating the causes of the perceived glass recyclate shortage in 2012 and subsequent price spike for PRNs. We also tasked them with identifying ways in which stability in the PRN system can be improved and ways of better identifying and mitigating price spikes in future. To assist with this work, WRAP commissioned Valpak Consulting to carry out a detailed study into glass packaging flows. The WRAP/Valpak GlassFlow report has gone back to first principles and produced a new estimate of glass packaging waste arisings based on a thorough and detailed analysis of the glass market. Their work indicates that the glass waste arisings figures (the so called 'flow' figure) that Government used to calculate our achievement of the EU Packaging Directive target, and set the statutory business targets for 2013-2017, is some 350k tonnes too high. The report also indicates that there is likely to be no incremental growth in the industry over the same period: at best it is flat.

¹ <https://www.gov.uk/government/publications/guidance-on-applying-the-waste-hierarchy>

The business target for obligated businesses is set at a level which is calculated to ensure the UK meets its recovery and recycling targets. It is set at a higher rate to take into account the de minimis producers who will not have glass obligations. Historically, the tonnage of glass packaging produced or handled by businesses that are out of scope due to de minimis has been relatively steady as a proportion of the total amount of packaging. Glassflow has indicated that this is no longer the case, and the tonnage of non obligated glass has fallen as a percentage of the total amount of glass packaging. This has resulted in a higher proportion of glass packaging recycling for the UK than previously estimated.

The government consulted on amending the glass packaging recycling targets that came into effect on 1 January 2013, with a view to reducing the target for obligated glass producers. There were different options, including amending the split target for end use.

The options under consideration were:

- Option 1 – Do nothing – keep the glass packaging recycling business target at 81% until 2017.
- Option 2a – Lower the glass packaging recycling business target to 75% and maintain the split between remelt and other applications at the same percentages:
- Option 2b – Lower the glass packaging recycling business target to 75% and amend the split between remelt and other applications.
- Option 3a – Lower the glass packaging recycling business target to 77% and maintain the split between remelt and other applications at the same percentages.
- Option 3b – Lower the glass packaging recycling business target to 77% and amend the split between remelt and other applications.

These options were based on ensuring we achieve a minimum level of recovery and recycling of glass in order to continue to meet the EU Packaging Directive minimum targets. Sub options 2a and 3a maintained the current split between remelt and other applications. Sub options 2b and 3b amended the split based on recalculations of the amount of recycling aggregate given the discovery of fraudulent activity.

Keeping the targets at current levels incurs higher costs on obligated producers to deliver the required level of recycling set by the business targets. This is indicated by the current PRN prices and the current evidence on costs and benefits. Options 2 and 3 deliver a net benefit, but also a net cost to business. This is due to the reduction in material revenue that reprocessing businesses receive which more than offsets lower collection and sorting costs for businesses. Obligated producers benefit significantly from a lower PRN price but this is offset directly by the lower PRN revenue received by reprocessors and exporters.

On the basis of the consultation responses, the UK government has taken the decision to proceed with an incrementally increasing business target that was suggested in some responses to consultation. In addition, the UK government has taken the decision to amend the end use split to reflect the reduction of aggregate in the market, with an incrementally increasing end use split rising from 35%/65% aggregate to remelt in 2014, to 34%/66% in 2015 and 33%/67% in 2016 onwards.

A summary of the impacts is listed below in Table 1.

Table 1: New business targets compared to consultation options

Summary of options	Option 2(a)	Option 2(b)	Option 3(a)	Option 3(b)	New Business Targets
Total change in obligated tonnage recycling	-481,730	-481,730	-321,154	-321,154	-381,370
Total reduction in obligated remelt	-305,899	-185,466	-203,933	-18,466	-73,263
Total reduction on obligated aggregate	-175,832	-296,264	-117,221	-302,687	-308,107
NPV £m 2014 prices	4.71	3.55	3.14	1.36	2.23
NPV to business £m 2014 prices	-3.24	-2.23	-2.16	-0.61	-1.15
Change in PRN impacts £m PV 2014 prices	-144.44	-144.44	-94.33	-59.29	-106.91
PRN price aggregate/remelt 2013 prices	22/22	22/22	28/30	22/40	22/31
CO2 impact £m PV 2014 prices	-0.84	-0.76	-0.56	-0.43	-0.55

NB: Figures will differ from consultation impact assessment due to change in price base year

The net benefit of the new business targets is £2.23m PV which is higher than option 3(b). However, on an assessment of the net cost to business, the new business targets have the second best impact on business (all of which are negative) of a net cost of £1.15m.

The business NPV is negative in all options which reflects the impact of reduced recycling on recovered material revenue. The chain of activity in recycling is complex and the impact of these proposals has distributional impacts. For obligated businesses, this will significantly reduce their costs of complying with the obligations. Reprocessors and exporters will see a correspondingly significant fall in their revenues. These businesses will, however still receive the PRN revenue for all the existing recycling. The new business targets balance the different impacts on the recycling supply chain.

1. Introduction

On 17 December 2013, the Government published a consultation seeking views on whether to amend the glass packaging business target to reflect new industry data regarding the amount of glass placed on the market. The consultation, which describes the options under consideration and the related impact assessment are available on the Government website².

The consultation closed on 17 January 2014. The Government has considered the responses submitted and taking into account the points raised through the consultation has recommended a hybrid option that a number of respondents suggested as an alternative to those which Government proposed. A summary of the final proposals that we will bring forward into legislation is provided in Section 4. The impacts of the proposed targets are described in Section 6.

The new targets will be as follows:

Year	Business Target	Split by end-use aggregate to remelt
2014	75%	35%/65%
2015	76%	34%/66%
2016 and onwards	77%	33%/67%

² <https://www.gov.uk/government/consultations/glass-packaging-recycling-proposed-changes-to-business-target>

2. Problem under consideration

During the 2012 compliance year, the UK experienced significant volatility in glass PRN prices. Low recycling figures published in the first half of the year meant there would have to be a considerable increase in the recycling rate in the latter half of the year to ensure the UK would meet its glass packaging recycling target for the year.

In 2012, based on what we had assumed the total amount of glass placed on the market was, the UK was projected to need to recycle 1,660k tonnes of glass packaging to meet the EU Directive target of 60%. This was based on the PackFlow³ mid-point estimate of glass packaging consumption in the UK. However, with low quantities of glass being accepted for reprocessing in the first three quarters of the year, this put significant pressure on the market to increase glass recycling in the last quarter. This saw PRN spot prices rise from around £10 per tonne early in the year to approximately £75 per tonne towards the end of the year⁴, meaning that the compliance costs for obligated glass packaging producers increased significantly.

The reasons for this volatility were not fully understood, so, as a result, Defra asked the ACP to investigate the causes of the perceived shortage of glass recyclate in 2012 and subsequent PRN price spike. They were also tasked with identifying ways in which stability in the PRN system could be improved and ways of better identifying and managing price spikes in future. Part of that exercise has involved the production of the 'GlassFlow'⁵ report. The WRAP/Valpak GlassFlow report has gone back to first principles and produced a new estimate of glass packaging waste arisings based on a thorough and detailed analysis of the glass market. The report also indicates that there is likely to be no incremental growth in the industry for the period 2013 to 2017 (this was also the case between 2008 and 2012), at best, it is flat.

The analysis in the GlassFlow report concluded that the flow/consumption of glass packaging onto the UK market is significantly lower than that estimated in the earlier PackFlow study. It has significantly changed our understanding of non-obligated glass production, and led us to the conclusion that the obligation placed on obligated businesses was higher than necessary. The main implication of the lower revised flow of glass packaging is that it significantly affects the UK's packaging glass recycling rate – it would suggest that the UK over achieved against the EU Directive target of 60% by some 8% or 185k tonnes of glass packaging in 2012.

Further, during 2011, it was discovered that there was evidence of the issuance of fraudulent PRNs, where PRNs were being sold for material that did not exist. The amount of fraud was significant, with GlassFlow estimating the amount at between 100,000 and 200,000 tonnes of PRNs issued for material that had not been collected or reprocessed. Previous analysis had therefore been distorted. Projected costs of meeting target levels of recycling were based on historical costs of compliance with the PRN system. However, the actual level of recycling in previous periods had been lower than assumed in the analysis owing to the fraud in the system. This served to bias estimates of the cost of meeting particular levels of recycling target downwards. Once the fraudulent tonnage had been removed from the reprocessed figures, it provided a more accurate view to the market of the likely availability of PRNs in future years and signalled that more glass packaging waste had to be obtained and processed in order to comply with the targets.

These factors combined have caused a shortage of glass packaging waste available to be recycled, an underestimate of the cost of achieving recycling targets and a subsequent increase in glass PRN prices. We are also overachieving at high cost against the Packaging Directive

³ http://www.valpak.co.uk/docs/default-source/environmental-consulting/packflow_2012_summary_report_and_recommendations.pdf?sfvrsn=0

⁴ Lets Recycle

⁵ <http://www.wrap.org.uk/content/glassflow-2012-report-0>

target. Glass producers have effectively been over-obligated as a result of these issues, and the consultation seeks views on addressing this over obligation by reducing the glass packaging targets.

The directly affected businesses are obligated packaging producers who have to pay for PRNs to meet the business recycling targets. There were 1,296 obligated packaging producers in 2012. There were 68⁶ accredited reprocessors and exporters that issue PRNs and receive money from obligated producers. Both these numbers change from year to year but give an indication of the number of businesses are directly affected by this policy through the PRN system. Due to this chain of activity, there are significant distributional issues associated with the proposed changes.

3. Rationale for intervention and Policy Objectives

There are negative externalities associated with the management and disposal of waste which result in environmental impacts such as greenhouse gas emissions and disamenity impacts. The full social cost of producing and dealing with waste is not taken into account in decisions by households and businesses. This results in the over-production of waste and sub-optimal allocation of waste treatment. Intervention by government can help reduce the amount of packaging waste to a more efficient level and shift packaging waste to more efficient treatment options. Without government intervention, the environmental benefits or costs associated with waste treatment options will not be reflected in their cost.

Packaging waste constitutes about 10% of the commercial and industrial (C&I) waste stream and about 20% of the household waste stream in the UK. Packaging provides benefits such as the protection of goods in transit and it helps ensure that products are undamaged. The benefits of packaging should be considered against the extra cost of producing and dealing with that packaging at the end of its life.

Recovery and recycling targets are set at a level to increase the amount of packaging that is recovered and recycled from a sub-optimally low level. There are environmental benefits from a shift from landfill to recycling and recovery. The shift reduces the adverse environmental impacts of the release of methane, a potent greenhouse gas from biodegradable material; possible damage to soil and water quality through leaching from landfill sites; disamenities such as noise and odour.

Recycling packaging results in reductions in emissions of greenhouse gases because less energy is used to produce recycled raw materials than in the production of virgin raw materials. It also avoids the extraction of raw materials, which can have a negative impact on the environment and biodiversity. Increased recovery and recycling of packaging waste could have amenity benefits by contributing to a decrease in packaging litter.

Externalities and reaching an efficient level of recycling

All environmental costs and benefits of waste disposal decisions are not reflected in the relative costs of each disposal option. The policy objective is to move towards a more efficient level of recycling.

In the absence of intervention in recycling, there are monetary incentives to move waste away from landfill, due to pre-existing regulation (the Landfill Tax). However, there are no incentives which reflect the *additional* benefits of recycling compared to other non-landfill options. Under

⁶ Source: NPWD

landfill tax, all materials are equally incentivised away from landfill, despite the benefits of different waste types moving up the waste hierarchy⁷ to recycling being very different.

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

1. Environmental externalities:

The existing key intervention, the landfill tax is £72/tonne in 2013/14 and rises to £80/tonne in 2014/15. At this level it takes into account the greenhouse gas externalities from landfill for all the materials in the packaging targets at current carbon prices.

Although the externality associated with landfill is covered, the landfill tax alone is insufficient to drive the right amount of recycling. The landfill tax does not aid the allocation of glass across all the treatment options in the waste hierarchy; prevention, re-use, recycling and recovery. Additional incentives are required to allocate across different treatment to a more efficient level.

There are different impacts for glass depending on the treatment option, which are not taken into account (in fact the aggregates levy incentivises glass to be used for aggregates rather than mining new materials and therefore doesn't reflect the carbon benefit of this glass being sent to an end use of remelt). For glass, there is a carbon benefit of moving glass from an end-use of aggregates to re-melt. The split target moves the proportions of end-use from other applications, including aggregates to re-melt, to reflect this carbon benefit.

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

2. Market Imperfections:

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

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

Intervention is required to move towards a more efficient level of recycling. This intervention may be statutory targets, voluntary producer responsibility deals or other alternatives. Where the intervention is statutory (mandating a higher recycling rate and resulting in a higher tonnage of PRNs required), the cost of the PRN to the producer (and resulting revenue to the recycling sector as a spend) addresses the environmental externalities to a certain extent.

Achieving targets set by EU packaging legislation

⁷ <https://www.gov.uk/government/publications/guidance-on-applying-the-waste-hierarchy>

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

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

Background – the Packaging Directive and producer responsibility in the UK

The environmental externalities associated with packaging waste are greenhouse gas emissions from sending packaging to landfill, disamenity impacts from littering and impacts on land use from landfill sites. Not all environmental externalities are internalised in decision-making by households and businesses. Intervention is required by government to reduce the environmental impact of packaging waste.

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 Packaging Directive sets a minimum overall recovery target of 60% (of which a minimum of 55% must be recycling), as well as material-specific recycling targets. For glass this is 60%.

These targets are to be met by Member States by 31 December 2008. After that date, Member States must continue to meet these minimum targets, but they have the freedom to set higher national targets.

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

Using a producer responsibility system to internalise some of the costs of dealing with packaging provides incentives for packaging producers to reduce the environmental impacts of waste and ensure a proportion is recycled. Packaging producers have to pay towards the cost of recycling and are therefore incentivised to reduce the total amount of packaging resulting in a reduction in the environmental impacts of packaging at the end of its life. If set at the correct level, the recycling target should reduce the environmental impact of packaging waste through reduced impacts of virgin material extraction and associated environmental impacts.

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

Under the Packaging Regulations, to show they have discharged this legal obligation, businesses must obtain evidence in the form of Packaging Waste Recovery Notes (PRNs) or Packaging Waste Export Recovery Notes (PERNs). These evidence notes are issued by accredited packaging waste reprocessors and exporters, respectively, and are bought by packaging producers. 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 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 business pay for these PRNs / PERNs. This internalises the cost of recovery and recycling to the packaging producers.

The Packaging Regulations include a de minimis threshold, exempting businesses which have a turnover below £2m and who handle under 50 tonnes of packaging a year; they are 'not obligated'. However the packaging that is handled by those exempt businesses still counts when calculating the UK's recycling performance. This is because the Packaging Directive Targets are set as a percentage of the total packaging waste arising in each Member State. 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. At the time the business targets were set in 2012, it was estimated that an 81% business target would achieve a UK recycling rate of 62%.

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

The price of PRNs and PERNs varies depending on availability. The Regulations do not mandate the use to which the proceeds from the sale of PRNs/PERNs to producers can be put, though accredited reprocessor 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.

Annex 1 fully explains the PRN mechanism and cash flows.

4. Description of options considered and Government decision

The consultation IA considered 5 options:

- Option 1 – Do nothing – keep the glass packaging business recycling target at 81% until 2017.
- Option 2a – Lower the glass packaging recycling business target to 75% and maintain the split between remelt and other applications at the same percentages:
- Option 2b – Lower the glass packaging recycling business target to 75% and amend the split between remelt and other applications.
- Option 3a – Lower the glass packaging recycling business target to 77% and maintain the split between remelt and other applications at the same percentages.
- Option 3b – Lower the glass packaging recycling business target to 77% and amend the split between remelt and other applications.

The majority of responses to the consultation (72% of responses to question 5) preferred a target reduction to 75% (Option 2) over the other options proposed, and 86% of responses

favoured some substantive reduction in the target. Only 14% of responses expressed a preference for no change from the current target.

77% of the consultation responses received were from producer members, trade associations (NB. The majority of trade association responses were for producers rather than reproprocessors) or producer compliance schemes and of these responses, 86% of them were in favour of a target reduction to 75% (Option 2).

A number of responses also suggested an alternative, hybrid approach of introducing an incrementally increasing business target: reducing the overall target for 2014 from 81% to 75% and then increasing incrementally to 76% in 2015 and 77% in 2016 onwards. The consultation responses who suggested this option felt that the initial step-change would introduce the desired reduction of glass tonnage from the market straight away which the producers are seeking, but by increasing the target over the subsequent years the incentive to invest in the system would be maintained. Consultation responses suggest that PRN markets respond best to gradually increasing markets and that by providing this signal the likelihood of a crash in the market by dropping the target will be minimised, but at the same time resulting in a meaningful and sustained reduction in producer costs.

Whilst UK government fully believes that whilst a reduction of the target to 75% is an attractive option as would be expected to produce the most notable reduction to PRN price, it would only be a short term fix to the market situation and current high producer costs. A reduction to 75% when the UK has already demonstrated 81% compliance poses the highest possibility of a sudden or significant PRN price drop. Whilst in the short term this will benefit producers in lower costs, it will impact on reproprocessors and deter investment in the longer term. A reduction in the necessary investment over the longer term could create a shortfall in meeting the targets at a later date. This will only serve to have the potential to cause price hikes later down the line and could ultimately result in similar scenarios to 2012/13.

The UK government has therefore taken the decision to proceed with an incrementally increasing business target as was suggested at consultation. In addition, the UK government has taken the decision to amend the end use split to reflect the reduction of aggregate in the market, with an incrementally increasing end use split rising from 35%/65% aggregate to remelt in 2014, to 34%/66% in 2015 and 33%/67% in 2016 onwards.

In summary the new targets will be as follows:

Year	Business Target	Split by end-use
2014	75%	35%/65%
2015	76%	34%/66%
2016 and onwards	77%	33%/67%

The UK government have agreed to this option as the best compromise as it appropriately balances a number of factors:

- It reduces the target downwards to reflect the **new and better evidence of both the total levels of glass packaging being placed on the market/available for recycling, and the proportion available for remelt.**
- The incrementally increasing target **provides greater head room over the EU minimum** in case the flow figures prove to be in accurate, or assumptions around growth change.
- An incrementally increasing target **strikes a balance between the costs of meeting the recycling targets and Government's continuing ambition to increase recycling rates.** Over 70% of consultation responses favoured reducing the target to 75%, whilst

reprocessors and other responses from the waste management industry favoured no change. It provides the immediate reduction in PRN expenditure that producer members will be seeking.

- However, by setting an incrementally increasing target, we **give industry a clear investment signal and time to invest**. This should enable higher recycling rates to be delivered in future at a lower cost than is currently possible.
- The increasing targets give UK Government **time to consider regulatory and non-regulatory amendments to improve the PRN system** which we hope will enable achievement of the higher recycling rates in a more transparent and less volatile system.
- The increased remelt target reflects the **expected effect of changing rules on waste collection across the UK** by helping to ensure a greater proportion of glass is available for recycling.

5. Consultation Responses

In their consultation responses, the overwhelming majority of respondents agreed that the estimates for waste arisings in the GlassFlow report is the best available data; agreed that a flat growth assessment was most sensible; agreed that the estimates made in GlassFlow for illegal imports is the best available data and supported the proposal to exclude the illegal imports from the flow figure.

Many of the responses made some form of comment on the consultation IA, relevant to a particular question or in general and a summary is in the Annex (Table A1). These comments included factors affecting the level of glass entering the waste stream or the obligated tonnage reported, and also wider issues about the operation of the PRN system.

6. Analysis of new business targets

Background

There were 17 comments in response to question 4 on the costs and benefits in the consultation Impact Assessment. The responses are summarised in Table 2 below. The majority of responses related to two issues; the choice of Option 1, the do nothing option as the baseline and secondly concerns with the transparency and workings of PRN system as a whole and the potential PRN price response to the proposals. These responses have not significantly changed the evidence base for the analysis but the concerns have been noted through providing a range around the best estimate for the proposal and the impact of the PRN price in the section on costs and benefits.

As the PRN system is market-based, it is impossible to predict the future PRN price. One respondent considered the recent investment could be expected to lead to a reduction in the PRN price in the do nothing scenario. This has partially been taken into account in the estimates of PRN prices in the counterfactual. It was also countered by a few responses which considered a risk of the PRN price not dropping as much as estimated in the analysis. To address the inherent uncertainty in the PRN price, the analysis includes the impact of a high and low range for the PRN price of 20%.

There were also responses to other questions that were relevant to the analysis. These included concern that the tonnage may fall due to the trend towards lightweighting and therefore there may be greater risk of missing targets if the obligated tonnage falls more rapidly than the flow figure. Sensitivity analysis to the flow figure and the percentage of obligated tonnage to the

total is discussed in the section on costs and benefits. Table A2 in the Annex details the responses.

Assessment of the counterfactual for glass recycling tonnage and impacts

Changes to glass packaging estimates are required as evidence has arisen since the announcement of targets in 2012 that indicates:

1. The baseline for costs and benefits had included fraudulent activity and therefore costs to achieve current targets are higher than previously estimated.
2. The total amount of glass packaging placed on the market is significantly lower than the projections used in 2012. This would reduce the amount of recycling required to achieve the EU packaging targets.

The consultation did not have any responses that altered the glass recycling tonnage estimates. The analysis for this can be found in the consultation Impact Assessment. There were some responses that identified factors that could affect the level of flow and obligated tonnage, such as increased light-weighting and an increasing gap between obligated and flow tonnages. Sensitivities to these factors are explored in a later section. Table 2 below shows the counterfactual as in the consultation IA.

Table 2: Counterfactual for glass recycling tonnage on existing business targets

	2013	2014	2015	2016	2017
Glassflow estimate of packaging placed on market (A)	2,399,235	2,399,235	2,399,235	2,399,235	2,399,235
Tonnage of glass obligated (actual in 2013, estimated 2014-17)	2,007,210	2,007,210	2,007,210	2,007,210	2,007,210
Current business targets	81.0%	81.0%	81.0%	81.0%	81.0%
Remelt	63.0%	63.0%	63.0%	64.0%	64.0%
Aggregate	37.0%	37.0%	37.0%	36.0%	36.0%
Total tonnes of obligated glass recycling through existing targets on obligated tonnage	1,625,840	1,625,840	1,625,840	1,625,840	1,625,840
Tonnes of obligated glass recycling through allocation method	5,396	5,576	5,576	5,576	5,576
total tonnes of obligated glass recycled through existing targets (B)	1,631,236	1,631,416	1,631,416	1,631,416	1,631,416
Of which remelt	1,024,279	1,024,279	1,024,279	1,040,538	1,040,538
Of which aggregate (allocated tonnage assumed to go to aggregate)	606,957	607,137	607,137	590,878	590,878
UK recycling rate (B/A)	68%	68%	68%	68%	68%

Source: NPWD, Glassflow

Taking into account the new estimated 'flow' figures⁸ the UK has achieved a much higher recycling rate for glass than current statutory requirements. The counterfactual for 2013-17 shows that the recycling rate will also remain high at an estimated 68% which is significantly above the 60% minimum EU requirement.

⁸ Glassflow Report

Given the comfortable margin of exceeding the UK's EU targets, it is possible to lower the business targets, recycling a lower total tonnage of glass and still meet our statutory and EU targets. The costs and benefits of lowering the business targets and changes to the split between remelt and other applications are considered below.

Costs and benefits of recycling

Costs and benefits are calculated for each additional tonne of recycling as per Porter ("The Economics of Waste", 2002) and it assumed the material is diverted from landfill.

1. The **additional tonnes of each material are calculated**, depending on the targets and projected tonnages.
2. The benefits per tonne are: the **material revenue** and the **value of the carbon benefit**;
3. The costs per tonne of each material are the additional costs of recycling (**collection and sorting costs** minus **savings in residual waste costs**)

There are additional environmental impacts such as disamenity impact of landfill sites. However the alternative treatment, recycling also incurs local environmental impacts. In the absence of accurate information on those impacts, the local disamenity impacts are described qualitatively but are not monetised. It is assumed that the local environmental impact of both a landfill site and a sorting facility for glass is likely to be negative.

Costs and benefits are per tonne.

The Social NPV is calculated as:

Additional tonnes x benefits of material (material prices & carbon)

– additional tonnes x costs of material (additional recycling collection costs, compared to residual route)

for each material.

Counterfactual costs and benefits of recycling glass

It is assumed that, at the margin, glass that is not collected for recycling is sent to landfill. Therefore the net cost or benefit of collecting and recycling an extra tonne of glass is the extra cost of collection net of the resource cost savings of reduced waste to landfill. The latest WRAP gate fees report has a median non hazardous gate fee of £21⁹. This is within the 5 year range assumed for gate fees and therefore is unchanged. The mixed waste collection costs were based on modelling¹⁰ are also assumed to remain unchanged. All figures are uprated to 2014.

Table 3: Summary of the best estimates for the costs and benefits updated to 2014 prices

Counterfactual prices per tonne 2014 prices	2014	2015	2016	2017
Collection and sorting - mixed	71.5	71.5	71.5	71.5
Collection and sorting - remelt	103.2	103.2	100.2	100.2
Residual + gate fee	61.2	61.2	61.2	61.2
Material Revenue - remelt	24.5	24.5	24.5	24.5
Material Revenue - aggregate	5.1	5.1	5.1	5.1
Carbon impact - remelt	2.0	2.0	2.1	2.2
Carbon impact - aggregate	1.3	1.3	1.4	1.4

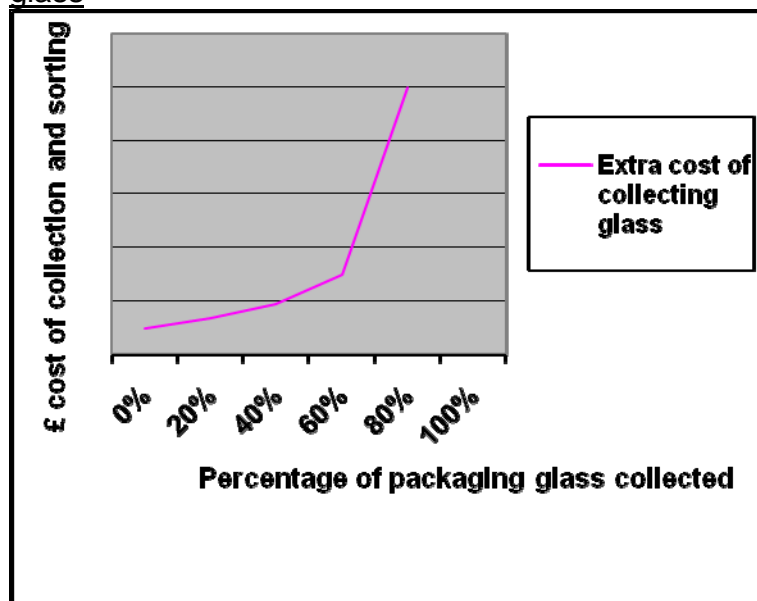
Source: WRAP, Packaging Targets IA 2012, DECC

⁹ <http://www.wrap.org.uk/content/wrap-gate-fees-report-2013>

¹⁰ Eunomia Landfill Bans model 2010

The marginal collection and sorting costs are unchanged from the consultation but a high and low range of 20% has been applied to reflect uncertainty. A range of 10% around the landfill costs has also been applied¹¹.

Figure 1: Example of the possible shape of the cost curve for collection and sorting cost for glass



The consultation impact assessment highlighted that we do not have sufficient evidence to accurately plot a marginal cost curve for collecting different percentages of glass at any point in time. Changes in many factors, including household behaviour and infrastructure scale can significantly affect this cost profile over time. Costs also differ according to geographical location and concentration of households. There is anecdotal evidence that costs may be lower in some local authorities. As we are using an average figure for the cost of collection and given that costs are likely to be upward sloping as in figure 1, and PRN costs should be determined by the marginal cost, it is possible the collection costs could be underestimated. On this basis a range of 20% above and below the best estimate are applied in the analysis in the next section.

C&I glass recycling

it would be cost beneficial to recycle more C&I glass as the collection and sorting costs are lower than for household waste. There have been limited increases in C&I collections so far, despite a high PRN price. This may indicate a steep cost curve or other barriers to collection from C&I some of which are well known¹².

It was noted in the consultation IA that there is evidence of investment in sorting capacity for C&I collected glass. The current estimates assume 65%/35% local authority to C&I which takes into account PRN investment leading to a stronger bias to C&I given the evidence on the lower costs and better infrastructure. It also reflects the proportions of glass in the residual waste stream. This is a more optimistic assumption than the Glassflow baseline projections for collections which assumes that the current split of 75% consumer and 25% non consumer will remain the same until 2017. If the higher proportions of C&I waste are not collected, then the costs of achieving unchanged targets would remain even higher.

¹¹ The range in the WRAP Gate Fees report 2013 indicates a much bigger range, but 10% is used as a reasonable range of uncertainty

¹² <http://www.wrap.org.uk/sites/files/wrap/Opportunities%20in%20glass%20hospitality%20contracts.pdf> p.7

Landfill diversion assumption

The benefits of an increase in recycling are based on diversion from landfill. Although the percentage of LACW that is incinerated is increasing and now accounts for 39% of residual waste treatment¹³, the analysis is not concerned with the average but the marginal tonne of residual glass. Contracts for incineration are typically fixed quantity with a variable element¹⁴. The amount of variability depends on several factors, including the type of contract and whether the facility is owner managed or 3rd party. The current trend is for capacity is taken up as soon as it becomes available as it is cheaper than landfill and therefore even this flexible element would be taken up immediately. A marginal tonne of glass is therefore assumed to be diverted from landfill as a fixed amount of residual waste goes to incineration and the expectation that any increase or decrease in residual tonnage is likely to go to landfill as the tonnage can vary, unlike incineration.

Landfill Tax impacts are calculated and detailed in the Annex, but as the tax is a transfer and does not have an impact on net costs and benefits it is not included in the analysis tables.

Material prices

The benefits of recycling an extra tonne of glass are the value of the recovered material and the avoided carbon emissions from not sending a tonne of glass to landfill and avoiding virgin material production. Recovered colour separated glass prices are currently £20-£45 per tonne (estimate of £24 over 5 year period in Packaging Targets IA) and mixed glass is £5-£25 per tonne (estimate of £5 over same period)¹⁵. Over the past 5 years, the highest mid-price for clear remelt has been £37.50 and for £17.50 for aggregate. This has been in the last year when PRN prices have been very high. These prices reflect recovered glass from a MRF, which is the higher proportion of household collected glass. There is a difference in price for recovered glass depending on the source from a MRF or kerbside sort¹⁶. There were no changes to these assumptions following the consultation and the prices are updated to 2014 giving a price of £24.50 for remelt and £5.10 for aggregate.

Carbon impacts

The carbon impacts remain as indicated in the Scottish Carbon Metric in Annex 4 of the Packaging Final Impact Assessment. Recycling a tonne of glass to remelt is assumed to save 390kg of carbon dioxide equivalent through the avoided emissions from virgin material production, net of the energy impact of recycling. For aggregate the assumed saving is 200kg of carbon dioxide per tonne recycled. Carbon impacts are valued in accordance with HMT Green Book guidance¹⁷. Updated traded carbon prices (detailed in Annex 2) have fallen significantly over the period (from £23 per tonne in the 2012 IA to £3.37 in 2014¹⁸ in this analysis) so the monetised carbon benefit of diverting a tonne of glass from landfill to remelt has reduced by over 80%.

There are additional energy benefits to producing glass from cullet (recovered glass) rather than raw materials. As glass producers pay their energy bills directly, it is assumed that the differential in costs arising from energy use will be taken into account when deciding on prices

¹³ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/255610/Statistics_Note1.pdf

¹⁴ This information is based on information from the Waste Infrastructure team within Defra

¹⁵ Source: Let's Recycle, September prices

¹⁶ WRAP also publishes prices as part of its Materials Pricing Report. In the third week of October: the prices for mixed glass ranged from £20 to £37 per tonne and the prices for colour separated glass ranged from £22 to £38 per tonne.

<http://www.mrw.co.uk/Journals/2013/10/29/q/l/o/MPR-October-week-4.pdf> There is a difference in mixed glass prices between the MPR and Let's Recycle. The mixed glass price in the MPR presents a range reflecting more kerbside sort while Letsrecycle more from a MRF. It is clarified in the MPR material specs on the MPR page what we are showing while recognising that lower quality mixed material is £10-£20 per tonne cheaper

¹⁷ Supplementary guidance provided by DECC <https://www.gov.uk/government/collections/carbon-valuation--2>

¹⁸ DECC https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/240095/short-term-traded-carbon-values-used-for-UK-policy-appraisal-2013-FINAL-URN.pdf

to pay for material inputs. This assumes that firms make efficient decisions on production choices. As glass producers are covered by EU ETS¹⁹, it is also assumed that the greenhouse gas impact associated with the energy use is also taken into account in decision-making.

Sensitivity of costs and benefits of counterfactual

Table 4: Net impact of recycling glass, 2014 prices

Best estimate per tonne, £ 2014 prices	Remelt	Aggregate
Collection and sorting for recycling	-103.2	-71.5
Change in landfill cost (collection and gate fee)	61.2	61.2
Material revenue	24.5	5.1
Carbon impact	2.0	1.3
Total net impact per tonne	-15.5	-4.0

Source: WRAP, DECC, Estimates

Under the current assumptions for the counterfactual, diverting a tonne of glass to either recycling or remelt is a net cost. A percentage change in the collection and sorting costs will have a greater influence over the net impact compared to the other factors such as material revenue and carbon impact. Using a 20% range on the best estimates could lead to significantly higher or lower net costs. A 20% lower cost of collection would make it cost beneficial to recycle both remelt and aggregate, giving a net benefit of £10.30 for aggregate and £5.10 for remelt. However, 20% lower cost of collection would result in a net cost to society of £36.20 for remelt and £18.30 for aggregate. Details are in the Annex.

The current best estimate of the cost of diverting a tonne of waste from landfill to recycling is greater than the combined monetised benefits of increased material revenue and carbon savings. A rise in the average material price for remelt from £24.50 to over £40.50 would shift the balance to a net benefit. For aggregate, we would need to see an increase from in aggregate prices from £5.10 to over £9.10. An increase in the traded carbon prices used in the analysis could also reduce the net cost. Short term traded carbon prices could increase in a scenario with a more ambitious cap on the EU ETS. A combination of a smaller rise in both carbon traded prices and material price could result in it being net beneficial to recycle glass at this level.

Non monetised impacts may also alter the net impacts. Other environmental impacts such as local amenity impacts from diverting a tonne of glass from a landfill facility to a sorting facility are not monetised. It is possible that some of the disamenity impacts may offset one another.

PRN price assumptions

Although PRN prices are affected by many factors, it is likely that the recent increase in PRN prices is an indication of the increase in costs of delivering glass recycling. Reported glass PRN prices were fairly low in 2011, with the price steady between £6 and £13 over the year. In 2012, however, the glass PRN spot price rose steadily from £9-12 in January to £75 in December²⁰. This trend continued in 2013. The target for glass was split into remelt and aggregate end use in 2013 and the related PRNs are currently £35-60 for aggregate and £50-70 for remelt (January 2014 prices)²¹. If we assume that all reprocessors and exporters face the same cost profiles, the price of PRNs should reflect the marginal costs and reprocessors and exports do not make excess profits. However if reprocessors and exporters do not face the same cost

¹⁹ Correspondence with British Glass

²⁰ Let's Recycle PRN price archive

²¹ Let's Recycle PRN prices

curves, then low cost businesses, or those than can access low priced recovered material will make higher profits.

In 2012, PRN revenue for glass was £44.5m. This compares to £14m in 2011 and £21m in 2010. Of the £44.5m PRN revenue in 2012, £7.5m was spent on infrastructure and capacity and £15.6m was spent on funding collection²². This investment may be expected to result in more efficient infrastructure and may possibly lower costs in the future.

Given the current higher marginal costs of collecting glass, and assuming some PRN revenue may be used to alleviate collection and sorting constraints, the costs of collection and sorting could be expected to fall over time. It is estimated that investment in infrastructure could feed through in the following year. This is based on information that it takes 12 to 18 months for a new sorting line to be installed. Some responses to consultation confirmed an expected fall in PRN prices although others were concerned that PRN prices may not fall as much as expected.

Counterfactual PRN price estimates

The consultation impact assessment had assumed that PRN prices would average £40 for aggregate and £45 for remelt (2013 prices) in a do nothing scenario. Responses to consultation indicated a mix of views with some expecting the PRN price to fall much further as a result of current investment. Others were concerned that the PRN price had remained so high and was likely to remain at high levels. PRN prices are driven by many factors and it is very difficult to estimate an average price so the counterfactual estimate remains unchanged. Some sensitivity to the PRN price change is performed in the analysis below.

Table 5: PRN price assumptions

PRN prices 2014-17 average (2014 prices)	2014	2015	2016	2017
PRN price- aggregate counterfactual	40.9	40.9	40.9	40.9
PRN price- remelt counterfactual	46.0	46.0	46.0	46.0

Costs and benefits of the proposed reduction in target and change to the split between remelt and other treatment

The expected new tonnages of recycling required are shown in Table 6, using the new annual business targets of and the latest obligated tonnage figure reported by businesses for the 2013 year. This shows there is a significant reduction in recycling tonnage required compared to the counterfactual of 7% in the first year and 5% by 2017. This equates to 120,433 tonnes in 2014 and 80,288 in 2014.

Table 6: Obligated glass recycling tonnage based on new business targets

	2014	2015	2016	2017
Obligated Glass tonnage (based on 2013 actual data and revised 0% growth rate)	2,007,210	2,007,210	2,007,210	2,007,210
Business Targets	75%	76%	77%	77%
remelt	65%	66%	67%	67%
Aggregate	35%	34%	33%	33%
Recycling rate	63.0%	63.8%	64.7%	64.7%
Total tonnes of glass recycled through new business targets and flow figures	1,505,408	1,525,480	1,545,552	1,545,552
Allocated Tonnage				

²² Source: NPWD, EA

	5,576	5,576	5,576	5,576
Total tonnes of glass recycled through new business targets and flow figures including allocated tonnage	1,510,984	1,531,056	1,551,128	1,551,128
Total tonnage recycling difference to counterfactual 81% business target in Table 3	-7%	-6%	-5%	-5%

Source: Glassflow, estimates

The resulting separated and mixed tonnages for remelt and aggregate end use are also shown below and compared against options 2(b), a reduction to 75% and an initial split of 65/35 remelt to aggregate and 3(b) a reduction to 77% both with an initial split of 66/34 in the consultation. The split increased by 1% to remelt in 2015 in both cases. The new business targets effectively start with a lower total tonnage in 2014 but result in a progressive increase in remelt tonnage and progressive fall in aggregate tonnage.

Table 7: Resulting tonnages of new business targets

Aggregate Tonnage	2014	2015	2016	2017
Previous option 2(b)	532,469	532,469	517,415	517,415
New targets	532,469	524,239	515,608	515,608
Previous option 3(b)	531,064	531,064	515,608	515,608
Remelt Tonnage				
Previous option 2(b)	978,515	978,515	993,569	993,569
New targets	978,515	1,006,817	1,035,520	1,035,520
Previous option 3(b)	1,020,064	1,020,064	1,035,520	1,035,520

This policy is expected to incur minimal transition costs as obligated tonnage needs to be calculated on an annual basis and in many cases is handled by compliance schemes. This change should require simply applying a different business target to the calculated tonnage obligation in each year. Compliance schemes and large businesses that calculate their own obligation are assumed to be frequent users of the National Packaging Waste Database system which has all the up to date information on it.

Taking into account the costs and benefits described in the counterfactual, the reduction in tonnage is expected to lead to a net benefit (it is assumed that at the margin, the packaging targets incentivise a shift from landfill to recycling). As the analysis in the counterfactual has show, the current level of recycling results in a net cost to society.

The benefit of diverting a tonne of glass from landfill to recycling is described in the counterfactual and shown again below:

Additional tonnes x benefits of increased recycling (material prices & carbon)
 – additional tonnes x costs of diverting material to recycling (additional recycling collection costs, compared to residual route)

With a reduction in the tonnage of glass recycling, the reverse will be calculated, i.e . the benefit of reduced collection and sorting costs will be offset by reduced revenue from the recovered material and increased greenhouse gas emissions (from reduced recycling and an assumed

increase in virgin material production)²³. Other impacts such as local disamenity impacts are not monetised in this analysis due to insufficient information on local environmental impacts.

For each tonne of glass not recycled, the impacts are calculated as follows:

Net reduction in collection costs	Reduction in collection for recycling , net of black bag collection costs and landfill gate fees (Table 6)
Reduction in greenhouse gas impacts	Carbon factors multiplied by carbon prices (Annex Table A6)
Reduction in material revenue	Material revenue per tonne (Table 6)

The breakdown for remelt and aggregate tonnages are detailed and summarised in the Annex. Overall the reduction in recycling tonnage to remelt is expected to reduce costs by £1.08m PV and the reduction in recycling tonnage to aggregate by £1.14m PV. This is a total impact of £2.23m PV over 4 years.

Impacts by affected party

Table 8 shows the impact by affected parties. It is assumed the split between household and business collections is 65:35 as described in the counterfactual. Taking this split, local authorities save £3.92m PV from no longer having to collect and sort household glass packaging but can send it to landfill instead. Local authorities and businesses will however have an additional cost of landfill tax for the 381,370 of extra glass that is assumed to go to landfill. This cost is not included in this summary of the net impact as the landfill tax is a transfer and does not affect the cost benefit analysis. Further details are in the Annex.

Table 8: Annual impacts of policy

Annual impact of policy £PV	2014	2015	2016	2017	Total
Net change in collection and sorting costs	2.70	1.54	0.91	0.88	6.03
of which savings to LAs	1.75	1.00	0.59	0.57	3.92
of which savings to business	0.94	0.54	0.32	0.31	2.11
CO2 impacts	-0.19	-0.14	-0.11	-0.11	-0.55
Material revenue that business does not receive	-1.50	-0.82	-0.47	-0.46	-3.26
Total £ NPV	1.01	0.58	0.33	0.31	2.23

PRN impacts

With lower targets and a correspondingly lower tonnage of glass recycling, it is expected that the average PRN price over the period would fall. For aggregate, a return to £22.50 (£22 uprated to 2014 prices) as in the consultation impact assessment is assumed. For remelt PRNs, the consultation impact assessment assumed a PRN price of £22 for option 2(b) and £40 for option 3(b). As the system is market based, it is difficult to estimate the impact on the PRN price of the tonnage changes proposed in the progressive target. An estimated PRN price of £31.70 is used, as it is the average between the two previous options, uprated to 2014 prices. This is subject to significant uncertainty.

A few responses to the consultation indicated a difference of view on the likely direction of the PRN price and highlighted a risk of the PRN price not falling as much as expected. A range of 20% around the PRN estimates is used to show the impact on the costs to obligated producers and change in income to reprocessors and exporters. This range is not used in the core

²³ Further details in Annex 2

estimates as there is not a clear relationship between the direction of collection costs and PRN price. Only the central estimate of the PRN price is used in the summary of the analysis.

Table 9: PRN price assumptions

PRN prices (2014 prices)	2014	2015	2016	2017
PRN price- aggregate counterfactual	40.9	40.9	40.9	40.9
PRN price- remelt counterfactual	46.0	46.0	46.0	46.0
PRN price after new business targets: aggregate	22.5	22.5	22.5	22.5
PRN price after new business targets: remelt	31.7	31.7	31.7	31.7

PRN price: high scenario

PRN price aggregate	27.0	27.0	27.0	27.0
PRN price remelt	38.0	38.0	38.0	38.0

PRN price: low scenario

PRN price aggregate	18.0	18.0	18.0	18.0
PRN price remelt	25.3	25.3	25.3	25.3

The PRN cost is a transfer between obligated producer of glass packaging who pay for the PRN and reprocessors or exporters who issue the PRN and results in no net impact on business NPV. The impacts are shown here for distributional purposes and are shown as both a gross cost and a gross benefit to businesses.

The impact of the changes to PRN costs for remelt and aggregate for each year is calculated as:

PRN price in counterfactual x tonnage reduction
Plus Change in PRN price x new obligated tonnage

This is calculated as a total of £148.7m (£136.5m PV) over 4 years of which £101.7m relates to the impact of a reduction in remelt tonnage and £47.0m relates to the reduction in aggregate tonnage. Further details of the underlying calculations are in the Annex.

Table 10: Summary of PRN impacts, best estimate

£ m	2014	2015	2016	2017	Total
Total change in PRN costs for remelt and aggregate	-28.95	-28.24	-27.61	-27.61	-112.41
Total change in PRN costs for remelt and aggregate PV	-28.95	-27.29	-25.77	-24.90	-106.91

Using the range of 20% around the best estimate of the PRN price, PRN prices of £27.00 and £38.00 for aggregate and remelt PRNs results in a low estimate of a reduction of £73.58m PV in PRN costs. If PRN prices fall 20% more than expected to £18 and £25.30, there is a greater reduction in PRN revenue of £140.25m PV.

Collection cost uncertainty

A high and low range for collection and sorting costs of 20% is applied to the analysis to take into account uncertainty. A high and low range for landfill collection and gate fees of 10% is also applied. If collection and sorting costs are higher or lower, it would be reasonable to assume that some of the factors may also make the residual waste collection costs higher or lower too. The ranges for benefits are shown below (underlying assumptions are in the Annex).

The resulting figures are symmetric around the best estimate with a low estimate of a net cost of £1.21m and a net benefit of £5.66m

Table 11: Impacts by affected party taking into account ranges for collection cost estimates

Impact by affected parties	Low cost scenario	Best estimate	High costs scenario
Net change in collection and sorting costs	2.59	6.03	9.47
of which savings to LAs	1.69	3.92	6.16
of which savings to business	0.91	2.11	3.31
PRN saving to obligated businesses	106.91	106.91	106.91
Total Benefit	109.51	112.95	116.38
CO2 impacts	-0.55	-0.55	-0.55
Material revenue that business does not receive	-3.26	-3.26	-3.26
PRN revenue that reprocessors and exporters no longer receive	-106.91	-106.91	-106.91
Total cost	-110.72	-110.72	-110.72
Total £ NPV	-1.21	2.23	5.66

Recycling glass avoids the production of virgin material and results in savings in greenhouse gas emissions. The new business targets will reduce the environmental benefits of avoided carbon emissions from recycling by £0.55m. Other environmental impacts such as local disamenity costs are not monetised. In total the net benefit of the policy is £2.23m (£-1.21m to £5.66m). As noted, the impact of the Landfill Tax is not taken into account in this analysis as it is a transfer payment. The figures are shown in the Annex. The total increase in Landfill Tax receipts is assumed to be £29.10m of which £10.19m is savings to businesses and £18.92 is savings to Local Authorities. This is an equivalent benefit to the government of an increase in tax revenue.

There are significant distributional impacts on businesses. Overall businesses in general benefit from no longer having to pay the collection costs of diverting waste from landfill of £2.11m PV (£0.91m to £3.31m range) but reprocessors will also no longer benefit from material revenue from recovered material (£3.26m PV). The PRN impact of a reduction in revenue of £106.91m net off each other, but have substantial distributional impacts. Overall the net impact to business is a gross benefit of £109.03m (£107.82m-£110.23m range), compared to gross costs of £110.10m which results in a net cost of £1.15m PV (£-2.35m to £0.06m range).

Table 12: Business impacts

Business impacts £m PV (2014 prices)	Low cost scenario	Best estimate	High cost scenario
Savings in collection costs	0.91	2.11	3.31
Reduced PRN costs	106.91	106.91	106.91
Total benefits to business	107.82	109.03	110.23
Material revenue no longer received	-3.26	-3.26	-3.26
PRN revenue no longer received	-106.91	-106.91	-106.91
Total costs to business	-110.17	-110.17	-110.17
Net impact	-2.35	-1.15	0.06

The EANCb on 2009 prices is calculated as benefits of £22.5m and costs of £22.7m resulting in a cost of £0.2m using the impact assessment calculator.

As the impacts are distributed through the supply chain for recycling, the costs and benefits will fall on different business groups. The net impact of the reduction in recycling leads to a net benefit overall as there are reduced costs to local authorities of £3.92m (£1.69m - £6.26m) resulting in a total gross benefit of £112.95m (£109.51m - £116.38m) which is greater than the overall costs of £110.72m (costs to business of £110.17m and the reduced greenhouse gas emissions of £0.55m).

Sensitivity analysis

The sensitivity of overall recycling achievement compared to business targets based on the new Glassflow figures is set out in the Annex in Table A12. It shows that setting the initial business target at 75% would achieve an estimated 63.0% UK recycling rate. This is a 62.6% rate when the allocated tonnage is deducted and is a similar recycling rate²⁴ used in the analysis to determine the 81% business target in the Packaging Targets 2013-17 impact assessment. One respondent suggested cutting the business targets further to 73%. Setting the business target at a lower rate than 75% would result in a greater risk of missing EU target of 60% should the obligated tonnage trend differ significantly from the overall glass flow trend. Obligated tonnage needs to fall by 4% relative to the overall flow for a business target set at 75% to miss EU target (assuming businesses fulfil their obligations). For 2017, a fall of more than 7% in the obligated tonnage will result in a recycling rate lower than the EU target. Some respondents noted the divergence between flow and obligated tonnage and the risk to overall achievement of national targets if this continues.

Summary

The new business targets are expected to initially alleviate the high costs that are being incurred by packaging producers to deliver a recycling rate that is higher than necessary to meet EU targets. Despite not being the lowest cost option at consultation, the new business targets balance the benefits to society overall with the estimated negative impact to businesses. The lowest cost option in the consultation was option 2(a) which was a reduction in the business target to 75% and maintaining the current split between remelt and aggregate. However, the impact of business overall was expected to be the most negative with option 2(a). Option 3(b), which was expected to deliver the least benefit overall, was also expected to be the least cost to business. A shift to remelt results in a higher net cost as it is less beneficial to recycle remelt compared to aggregate, despite the environmental benefits of remelt. At the time the packaging targets were set in 2012, the response to consultation was to favour a split target despite the net cost of doing so. The current targets rebalance that split to maintain the level of aggregate recycling at the level it would have been in 2011, had there not been fraudulent activity in aggregate PRNs.

Table 13: New business targets compared to consultation options

Summary of options	Option 2(a)	Option 2(b)	Option 3(a)	Option 3(b)	New Business Targets
Total change in obligated tonnage recycling	-481,730	-481,730	-321,154	-321,154	-381,370
Total reduction in obligated remelt	-305,899	-185,466	-203,933	-18,466	-73,263
Total reduction on obligated aggregate	-175,832	-296,264	-117,221	-302,687	-308,107
NPV £m 2014 prices	4.36	3.34	2.92	1.32	2.23
NPV to business £m 2014 prices	-3.26	-2.24	-2.17	-0.60	-1.15
Change in PRN impacts £m PV 2014 prices	-141.33	-141.33	-94.21	-58.00	-106.91
PRN price aggregate/remelt 2013 prices	22/22	22/22	28/30	22/40	22/31

²⁴ It was calculated that a business target of 81% would achieve a 62.1% recycling rate, not taking allocated tonnage into account.

CO2 impact £m PV 2014 prices	-0.84	-0.74	-0.55	-0.42	-0.55
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NB: Figures will differ from consultation impact assessment due to change in price base year

The net benefit of the new business targets is £2.23m PV which is higher than option 3(b). However, on an assessment of the net cost to business, the new business targets have the second best impact on business (all of which are negative) of a net cost of £1.15m.

The business NPV is negative in all options which reflects the impact of reduced recycling on recovered material revenue. The chain of activity in recycling is complex and the impact of these proposals has distributional impacts. For obligated businesses, this will significantly reduce their costs of complying with the obligations. Reprocessors and exporters will see a correspondingly significant fall in their revenues. These businesses will, however still receive the PRN revenue for all the existing recycling.

The UK Government's overarching aim is to have appropriate targets which ensure that the UK complies with the EU Packaging Directive targets whilst maximising the benefits for consumers, businesses and the environment. The new business targets are expected to deliver a reasonable level of confidence of achieving those targets while aiming to ensure that obligated producers are not having to pay very high prices to achieve recycling above those levels.

OITO

One In Two Out

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

SPECIFIC IMPACT TESTS

Equity and Fairness

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

Small firms impact test

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

Competition

The proposed target scenarios will affect the recovery and recycling obligations of approximately 1,360 businesses in the UK (glass producers and reprocessors, exporters). The costs incurred under any new targets (in the same way as for existing targets) will vary between businesses, since the costs are related to the amount and type of packaging the business handles.

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

The Government have examined competition in the recycling market, material specific market (e.g. glass and plastic) and the end user market (e.g. the market for bottles). In general, the Government has been unable to identify markets where there are serious competition concerns. Competition in the recycling market is unlikely to be adversely affected as a result of adopting any of the proposed options and related targets.

Annex 1 PRN/PERNs Mechanism and Cash Flows

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

In theory, in a functioning market with few imperfections, the additional PRN/PERN cash flows should reflect the costs of collecting, sorting, and transporting the additional waste to the reprocessor, minus the revenues from the sale of the material collected at the reprocessor gate²⁵ and the 'costs avoided' of collecting the materials as refuse and disposing these to landfill (see Box 2).

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

Box 2: Costs for collection of household packaging waste

A) Cost of collecting and sorting, and delivery of segregated packaging to reprocessor	Say £110 per tonne
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Revenues

B) Avoided landfilling cost of packaging material	Say £50 per tonne
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C) Market value (price paid) of packaging material for sale to reprocessor	Say £20 per tonne
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Revenue Total	£70 per tonne
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D) Net loss	£40 per tonne
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To cover (D) revenue needs to come from the PRN system. A number of actions (or combination of actions) can be taken, for example:

- pay capital cost of the system (A) - thus reducing the operational costs;
- invest in technology, develop new markets for recycled material to increase demand, hence the value of packaging waste and price (C);

The decision is in the hands of industry, primarily the reprocessors in collaboration with obligated businesses, on what mixture of support measures is needed for any given material.

Other factors can affect (A), (B) and (C) and hence the deficit (D) the PRN revenues need to cover. For example:

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

²⁵ Alternatively, the value of the reprocessed material could be considered alongside the additional, average re-processing cost.

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

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

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

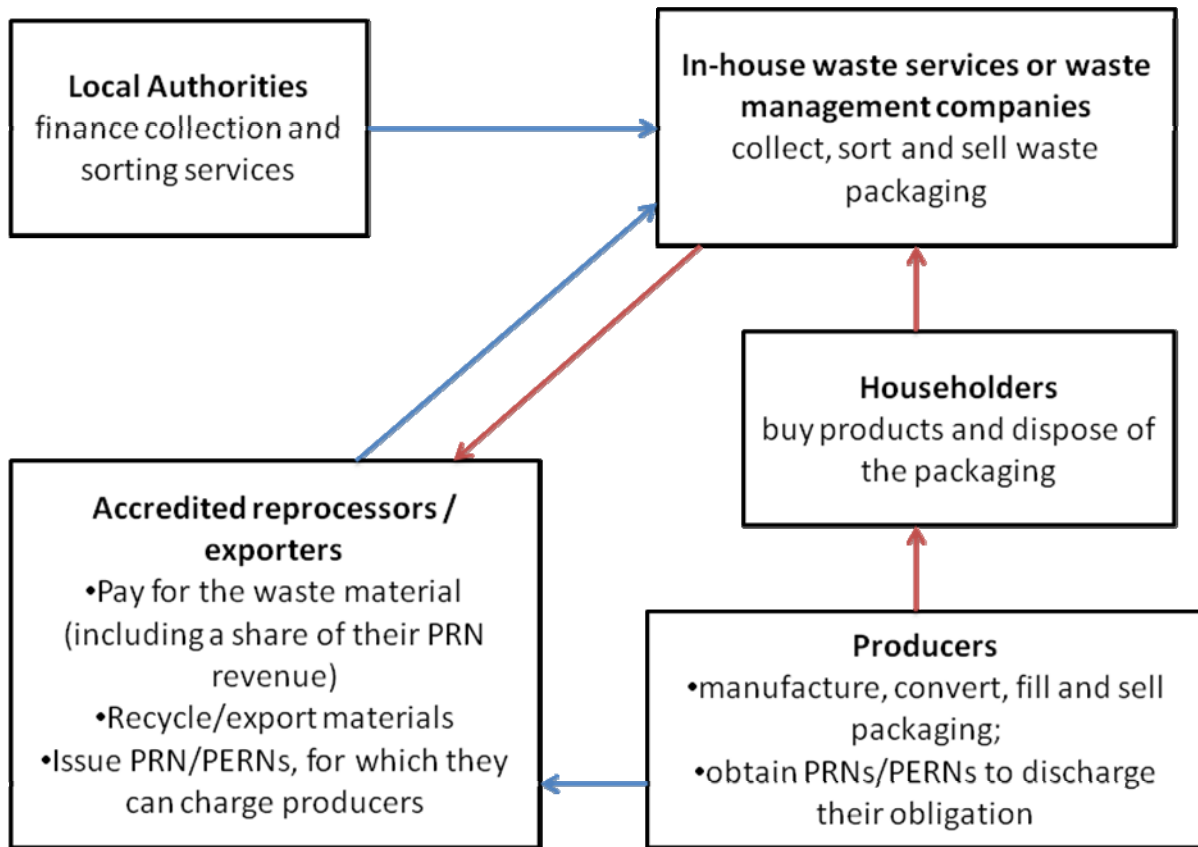
To a limited extent, given market imperfections, the estimated costs for PRNs can be used to cross check the anticipated costs of acquiring additional packaging waste. PRN costs should (in an effective market) broadly equate to the difference between material revenues (at the reprocessor gate) plus avoided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

Figure 1 gives a depiction of the flow of funds within the PRN system on the household side²⁶.

Figure 1: Funds flow of PRNs (household)

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

²⁶ There is a funding issue here with regard hidden subsidy to producers from local authorities, in that some packaging waste gets picked up by local authorities and treated as municipal waste and therefore funded by local authorities rather than business.



Annex 2: Consultation responses

Table A1: Consultation responses

Comment	Government Response
<i>Factors affecting the level of glass entering the waste stream</i>	
Operational issues such as plant malfunction, transport issues such as delays or weather, recession	Whilst Government accepts that all of these factors could affect the level of glass entering the waste stream from year to year, we are satisfied that GlassFlow provides the most robust information available to us on which to set the targets. We will ensure that this data is reviewed on a regular basis to ensure appropriately set targets.
Lightweighting; substitution of glass with other packaging materials	
Non-adjusted NPWD figures should be used	
High glass PRN price	
A significant number of free riders	
<i>Factors affecting the levels of obligated tonnage reported</i>	
PRN prices in previous year/market conditions/compliance costs	Whilst Government accepts that these factors could affect the level of obligated

Material substitution	tonnage reported, we are satisfied that the targets are being set on the most robust information available. We will ensure that data is reviewed regularly.
Administrative errors	The Environment Agencies are working to ensure that fraudulent activity is eliminated from the system
No/poor enforcement of the regulations by the EAs	
Businesses avoiding their legal obligations, free riders	
Fraudulent activity	
Other comments for consideration	
Addressing fraud will create market stability	Out of scope of this consultation, but Government are actively exploring whether regulatory or non-regulatory solutions can be made to address these concerns
Flow data should be reviewed annually/more regularly, Review other materials flow figures, ACP to have a data monitoring role	Out of scope of this consultation, but Government intend to ensure that this data is reviewed on a rolling basis, including for other materials.
Lack of transparency of how the PRN price is determined, how the PRN market operates and how PRN revenue is spent – suggestion for Industry Code of Practice on transparency, incl making market data more public.	Out of scope of this consultation, but Government will consider whether regulatory or non-regulatory solutions can be made to address these concerns.
An auditing process be devised to ensure that the monies received by recycling companies are open to scrutiny to ensure that they are used solely for recycling.	
Concern about operation of a genuine free market	
Lack of a level playing field between PRN and PERN	Out of scope of this consultation, but we are actively exploring the potential to make amendments to Environment Agency guidance to start to even out any disparity in the playing field in the PRN/PERN system
The aim of PRN system should be to achieve the statutory recycling targets at minimal cost to business (ie. set targets to lowest possible level - .	Out of scope of this consultation, but the EU Packaging Directive gives Members States freedom to set higher national targets. Government considers it to be appropriate to set higher targets as it supports our overall environmental objectives of achieving high recycling rates.
Monthly rather than quarterly reporting	Out of scope of this consultation, but Government will consider whether regulatory amendments are appropriate as part of the Producer Responsibility Review.
Set a requirement for reprocessors to sell PRNs at regular intervals throughout the compliance year.	
Split target should be removed.	Out of scope of this consultation, but Government have ambitions towards a closed loop economy and the split target

	is in line with the waste hierarchy and our policy drivers to reduce carbon emissions.
Set targets for 2018 and 2019 thereby enabling appropriate planning	Out of scope of this consultation, but Government will consider in adequate time.
Focus on interventions such as deposit/cash-back schemes to maximised household recycling, or “Pay as you Throw” for household waste.	<p>Out of scope of this consultation. Whilst we accept that introducing a deposit scheme could increase recycling and reduce litter, estimated running costs of such a scheme are very high, including costs to businesses, and much higher than developing existing systems for collection and recycling which could achieve the same aims more cost effectively. There is also the potential that a deposit return scheme would have harmful effects on existing recycling collection schemes, including local authorities’.</p> <p>Government consider that “Pay as you Throw” is not appropriate way to encourage positive waste behaviours.</p>

Table A2: Responses to consultation question on evidence base and analysis

Details of response	Change to IA
Option 0 is not the appropriate baseline as we are over- achieving targets	The counterfactual, do nothing option is not to change anything, therefore it is the correct baseline.
Comments on PRN system and need for changes to the system such as improving transparency	IA notes concerns about the overall PRN system and risks
PRN price may not fall as much as expected	IA notes risk of PRN prices not falling as much as expected.
PRN price will fall lower than baseline	Note will be made that the PRN price could fall further due to scale of investment.
Targets should be lowered to 73%	There is a significant risk to achievement on EU targets should the flow figure fall therefore this option was not considered. Sensitivity to changes in the flow figure and achievement of EU targets are detailed in the IA.
PRN costs do not add up correctly for 2a and 2b	It is correct. In both cases all the PRN prices fall to £22 and therefore it is only the total tonnage that makes a difference.
Benefit of avoided cost savings to glass producers and full environmental impact. Contribution of a high glass recycling rate to EU recycling targets	The costs savings are to glass producers and should be taken into account by them through existing policies such as EU ETS. This was noted in the consultation IA. EU

	targets may be achieved in a more cost effective manner.
Flow data quality is important	Quality of flow data is recognised as important
IA difficult to understand and business is not well defined. PRN price will fall lower than baseline	This IA has been simplified. It is noted that the PRN price could fall further due to scale of investment.

Annex 3: Details for analysis of costs and benefits

Table A3: Detailed of PRN issuance, carry over and total recycling recorded 2009-13

Year	Waste Accepted for UK Reprocessing	Waste Exported for Overseas Reprocessing	Total Waste Accepted or Exported	Carry over from previous year into the current compliance period	PRN availability for the current compliance period	UK producer obligation (non Allocation method)	UK Producer obligation (Allocation method)	Overall UK producer glass obligation	End of the year compliance by schemes /producers
2009	1,294,207	364,260	1,658,467	66,836	1,725,303	1,648,990	4,172	1,653,162	1,652,750
2010	1,385,896	262,022	1,647,917	63,657	1,711,574	1,692,779	4,545	1,697,324	1,697,095
2011	1,455,387	296,439	1,751,826	12,215	1,764,041	1,697,020	5,808	1,702,828	1,702,962
2012	1,314,998	311,590	1,626,588	58,592	1,685,180	1,659,863	5,524	1,665,387	1,665,378

Source: NPWD, EA

Table A4: Calculations of impact of fraudulent activity and resulting best estimate of actual recycling activity in 2009-10

Estimated impact of fraud activity	Reported recycling	Fraudulent activity		Actual recycling		
		High estimate	Low estimate	Low estimate	High Estimate	Best estimate (mid point)
2009	1,658,467	200,000	100,000	1,458,467	1,558,467	1,508,467
2010	1,647,917	200,000	100,000	1,447,917	1,547,917	1,497,917

Source: NPWD, Glassflow

Table A5: Change in annual recycling tonnages taking fraudulent activity in 2009-10 into account

Impact of fraudulent activity on tonnage increases	2009	2010	2011	2012	2013
Total tonnes of glass recycled through existing targets (based on reported tonnage)	1,658,467	1,647,917			
Actual amount of glass recycled (best estimate, taking off the estimate of fraud activity)	1,508,467	1,497,917			

Actual glass recycled based on existing business targets and obligated tonnage, 2011-13 actual figures ²⁷			1,702,828	1,665,387	1,631,236
Amount carried over from previous year's compliance			12,215	58,592	17,302
Net amount of glass to be recycled (actual 2011 and 2012). Calculated for 2013 ²⁸			1,751,826	1,626,588	1,613,934
Increase in amount of glass to be recycled compared to actual estimated recycling in 2010 (best estimate)			253,909	167,470	133,319
Percentage difference in amount of glass to be recycled compared to 2010 (best estimate)			17%	11%	9%

Table A6: Carbon factors and prices

Carbon Factors per tonne of glass recycled	Traded	Non-traded
Remelt	0.38	0.19
Carbon impact to remelt - non traded	0.01	0.01

Carbon prices	2014	2015	2016	2017
CO2 traded price 2014	3.67	3.75	4.01	4.31
CO2 non traded price 2014	60.5	61.6	62.6	63.7

Source: DECC, non traded carbon prices are uprated from 2011 to 2014 using the GDP deflator. Trade carbon prices uprated to 2014.

Table A7: Assumptions for collecting and sorting glass for recycling (2013 prices)

Collection and sorting costs	Household	C&I
Mixed	£107	£44
Separated	£113	£80

Source: WRAP

Table A8: Actual obligated tonnage 2010-2013

Obligated tonnage for glass	2010	2011	2012	2013
Reported obligated tonnage	2,089,286	2,090,803	2,049,180	2,007,210
% change year on year		0.1%	-2.0%	-2.0%
UK producer obligation (non Allocation method)	1,692,779	1,697,020	1,659,863	1,625,840
UK Producer obligation (Allocation method)	4,545	5,808	5,524	5,396
Overall UK producer glass obligation	1,697,324	1,702,828	1,665,387	1,631,236
% Change year on year		0.3%	-2.2%	-2.1%

Source: NPWD

Table A9: Estimated recycling rate using updated flow figures from Glassflow

	2011	2012	2013	2014	2015	2016	2017
Glassflow estimate of packaging placed on market (tonnes)	2,427,657	2,399,235	2,399,235	2,399,235	2,399,235	2,399,235	2,399,235
% change YoY	-2%	-1%	0%	0%	0%	0%	0%
Tonnage of glass obligated (actual to 2013, estimated 2014-17)	2,090,803	2,049,180	2,007,210	2,007,210	2,007,210	2,007,210	2,007,210
Tonnes of glass recycling through	5,808	5,524	5,396	5,576	5,576	5,576	5,576

²⁷ 2013 figure is subject to change as the year has not been finalised.

²⁸ The actual amount of recycling does not equate to the obligation minus the carryover from previous year due to carry over into the next year. . 2013 figures assume zero carry over for simplicity.

allocation method									
Total tonnes of glass reported as recycling compliance through existing targets (2011-12 actual; 2013-2017 forecast producer obligation)	1,702,962	1,665,378	1,631,236	1,631,416	1,631,416	1,631,416	1,631,416	1,631,416	1,631,416
Recycling rate achieved on Glassflow figures	70%	69%	68%	68%	68%	68%	68%	68%	68%

Source: Glassflow

Table A10: Ranges for collection and sorting costs

Collection and sorting costs 2014 prices (high)	2014	2015	2016	2017
Mixed	85.8	85.8	85.8	85.8
Separated	123.9	123.9	120.2	120.2
Residual + gate fee (10% higher)	67.3	67.3	67.3	67.3

Collection and sorting costs 2014 prices (low)	2014	2015	2016	2017
Mixed	57.2	57.2	57.2	57.2
Separated	82.6	82.6	80.1	80.1
Residual + gate fee (10% lower)	55.0	55.0	55.0	55.0

Table A11: Impact of high and low collection and sorting costs on net impact per tonne

High cost scenario

Low cost scenario

2014 Prices - high cost/low prices	Remelt	Aggregate
Collection and sorting for recycling	-123.9	-85.8
Change in landfill cost (collection and gate fee)	55.0	55.0
Material revenue	24.5	5.1
Carbon impact (2013 prices)	2.0	1.3
Total	-42.3	-24.4

2014 low cost/high prices	Remelt	Aggregate
Collection and sorting for recycling	-82.6	-57.2
Change in landfill cost (collection and gate fee)	67.3	67.3
Material revenue	24.5	5.1
Carbon impact (2013 prices)	2.0	1.3
Total	11.2	16.5

Detailed calculations for cost benefit analysis

Table A12: Relationship between business targets and actual recycling rate based on Glassflow estimates

	2014	2014	2014	2014	2014	2014	2014	2014	2014	2014
Glassflow estimate	2,399,235	2,399,235	2,399,235	2,399,235	2,399,235	2,399,235	2,399,235	2,399,235	2,399,235	2,399,235
Obligated tonnage	2,007,210	2,007,210	2,007,210	2,007,210	2,007,210	2,007,210	2,007,210	2,007,210	2,007,210	2,007,210
Business target	81%	80%	79%	78%	77%	76%	75%	74%	73%	72%
Recycling compliance from business target	1,625,840	1,605,768	1,585,696	1,565,624	1,545,552	1,525,480	1,505,408	1,485,335	1,465,263	1,445,191
Recycling compliance from allocated	5,576	5,576	5,576	5,576	5,576	5,576	5,576	5,576	5,576	5,576

tonnage											
Total recycling compliance required	1,631,416	1,611,344	1,591,272	1,571,200	1,551,128	1,531,056	1,510,984	1,490,911	1,470,839	1,450,767	
Recycling rate	68.0%	67.2%	66.3%	65.5%	64.7%	63.8%	63.0%	62.1%	61.3%	60.5%	

NB rounding issues result in some tables not totalling up

Table A13: Change in tonnages from new business targets

Change in total glass recycled	2014	2015	2016	2017	Total
Total change in glass recycled (t)	- 120,433	- 100,361	- 80,288	- 80,288	- 381,370
Change in glass to remelt (t)	- 45,764	- 17,463	- 5,018	- 5,018	- 73,263
Change in glass to aggregate (t)	- 74,668	- 82,898	- 75,270	- 75,270	- 308,107

Table A14: Summary of impacts of reduction in recycling tonnage 2014-17 (best estimate)

Impact of reducing remelt recycling no longer required	2,014	2,015	2,016	2,017	Total
Tonnage change	- 45,764	- 17,463	- 5,018	- 5,018	
Net change in collection and sorting	1,924,679	734,417	195,654	195,654	
CO ₂ impacts	- 91,502	- 35,640	- 10,781	- 11,418	
Material revenue	- 1,122,509	- 428,326	- 123,082	- 123,082	
Total	710,668	270,451	61,791	61,154	1,104,065
Total PV	710,668	261,306	57,683	55,157	1,084,814
Impact of reducing aggregate recycling no longer required	2014	2015	2016	2017	Total
Tonnage change	- 74,668	- 82,898	- 75,270	- 75,270	
Net change in collection and sorting	774,628	860,004	780,875	780,875	
CO ₂ impacts	- 97,241	- 110,112	- 104,420	- 109,590	
Material revenue	- 381,555	- 423,608	- 384,632	- 384,632	
Total	295,832	326,285	291,824	286,654	1,200,594
Total PV	295,832	315,251	272,421	258,545	1,142,049

Table A15: High and low range for collection and sorting costs

Collection and sorting costs 2014 prices (high)	2014	2015	2016	2017
Mixed	85.8	85.8	85.8	85.8
Separated	123.9	123.9	120.2	120.2
Residual + gate fee (unchanged)	61.2	73.4	73.4	73.4

Collection and sorting costs 2014 prices (low)	2014	2015	2016	2017
Mixed	57.2	57.2	57.2	57.2
Separated	82.6	82.6	80.1	80.1
Residual + gate fee (unchanged)	61.2	61.2	61.2	61.2

Table A16: Landfill tax impacts of new business targets

New Business Targets: Landfill tax impacts	2013	2014	2015	2016	2017	Total
Tonnage assumed to go to landfill		120,433	100,361	80,288	80,288	381,370
Landfill tax rate From March £	64.00	72.00	80.00	80.00	80.00	
Total impact £ m		8.43	7.83	6.42	6.42	29.10

Table A17: PRN impacts breakdown

£ m	2014	2015	2016	2017	Total
Change in remelt PRN costs from lower obligated recycling tonnage	-2.10	-0.80	-0.23	-0.23	-3.37
Change in remelt PRN costs from lower PRN prices for the remaining obligated recycling tonnage	-14.00	-14.41	-14.82	-14.82	-58.04
Change in aggregate PRN costs from lower obligated recycling tonnage	-3.05	-3.39	-3.08	-3.08	-12.60
Change in aggregate PRN costs from lower PRN prices for the remaining obligated recycling tonnage	-9.80	-9.64	-9.49	-9.49	-38.41
Total change in PRN costs for remelt and aggregate	-28.95	-28.24	-27.61	-27.61	-112.41
Total change in PRN costs for remelt and aggregate PV	-28.95	-27.29	-25.77	-24.90	-106.91

Table A18: Collection costs scenario

Low collection costs

Annual impact of policy(PV)	2014	2015	2016	2017	Total
Net change in collection and sorting	1.42	0.64	0.27	0.26	2.59
CO ₂ impacts	-0.19	-0.14	-0.11	-0.11	-0.55
Material revenue	-1.50	-0.82	-0.47	-0.46	-3.26
Total PV	-0.27	-0.32	-0.31	-0.31	-1.21

High Collection costs

Annual impact of policy(PV)	2014	2015	2016	2017	Total
Net change in collection and sorting	3.98	2.44	1.55	1.50	9.47
CO ₂ impacts	- 0.19	- 0.14	- 0.11	- 0.11	- 0.55
Material revenue	- 1.50	- 0.82	- 0.47	- 0.46	- 3.26
Total PV	2.28	1.48	0.97	0.93	5.66