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COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Proposal for a
DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

amending Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, 1999/31/EC on the landfill of waste, 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment

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Executive Summary

A. Need for action

Although waste management continues to improve in the EU, the EU's economy currently loses a significant amount of potential secondary raw material which is found in the waste stream. In 2010, total waste production in the EU amounted to 2,5 billion tons. From this total only a limited (albeit increasing) share (36%) was recycled, with the rest being landfilled or burned of which around 4 to 500 million tons could be recycled or reused. The EU thus misses out on significant opportunities to improve resource efficiency and create a more circular economy, create growth and jobs, take cost-effective measures to reduce greenhouse gas emissions and reduce its dependency on imported raw materials.

Without new initiatives to improve waste management in the EU, significant amounts of valuable resources will continue to be lost in the coming years. Without a clear perspective for the medium- to long-term, the EU risks seeing increased investments in inflexible, large-scale projects focused on the treatment of 'residual' waste, which may stand in the way of the potential to improve resource efficiency though reducing waste generation at source, and reusing and recycling more of the waste which is generated. The dissemination of best practices between Member States (MS) will remain limited and economic conditions will not enough incentive waste prevention, re-use or recycling leading to the persistence of large divergences in terms of waste management performances between MS. In addition, the quality of essential monitoring tools such as statistics on waste generation and management will remain sub-optimal and a number of reporting obligations will remain complex without having much added value.

B. Solutions

On the basis of an in depth analysis of what has worked and not worked in the past and after extensive stakeholder consultation, the following options (and a series of sub-options and specific measures) were retained for more detailed analysis:

Option 1 – Ensuring full implementation: No additional EU action apart from compliance promotion

Option 2 – Simplification, improved monitoring, diffusion of best practices: This includes measures aimed at:

- Aligning definitions of key concepts (e.g. 'recycling' and 'reuse') and remove obsolete requirements
- Simplifying measurement methods (only one method to measure 'household waste and similar waste' target) and reducing reporting obligations
- Creating national registries on waste collection and management and require third party verification of key data and statistics
- Introducing an early warning procedure to monitor Member States performance and require timely correcting measures when needed
- Establishing minimum conditions for the operation of producer responsibility schemes

Option 3 – Upgrade EU targets:

No new targets will be proposed under this option, existing target would be upgraded and clarified for some of them though obsolete targets would be removed.
The current performances of the most advanced Member States and the time which was needed to meet these targets was taken into account to propose realistic targets and deadlines for all MS while meeting the main objectives of the 7th EAP.

Option 3.1 – Increase the recycling/reuse target for municipal waste:

- Low: 60% reuse/recycling target by 2030; 50% by 2025
- High: 70% reuse/recycling target by 2030; 60% by 2025

Option 3.2 – Increase the re-use/recycling targets for packaging waste:

- Increased material based targets between 2020 and 2030 (80% overall reuse/recycling)
- Variant: specific separate target for nonferrous metals ('metal split')

Option 3.3 – Phasing out landfilling of recoverable municipal waste:

- Ban on plastic/paper/glass/metals by 2025 (max 25% landfilling), global ban by 2030 (max 5%)

Option 3.4 – Combination of options 3.1, 3.2 and 3.3 (with further sub-options 3.5-3.7)

C. Impacts of the preferred option

The preferred option is a mix of option 2 and option 3.4 in combination with an extended landfill ban (i.e. option 3.7). Compared to full implementation, this preferred option will bring several benefits in terms of:

- Administrative burden reduction in particular for SMEs, simplification and better implementation including by keeping targets 'fits for purpose'.
- Job creation – more than 180.000 direct jobs could be created by 2030, most of them impossible to delocalize outside the EU.
- Greenhouse gas emission reduction – around 62 million of tons could be avoided annually in 2030 (443 million between 2014 and 2030) .
- Secondary raw materials will be re-injected in the economy – more than doubling what was recycled in 2011for municipal and packaging waste. Proposed measures will serve as catalyst for ensuring the implementation of all EU targets which will contribute to cover between 10% and 40% (depending of the material) of the EU total raw material demand.
- Positive effects on the competitiveness of the EU waste management and recycling sectors as well as on the EU the manufacturing sector (better EPR, reduced risks in terms of raw material access and prices).
- Marine litter levels 13% lower by 2020 and by 27,5% lower by 2030.

The proposed midterm targets will give the needed clear signal to MS and waste operators so that new strategies and investments can be adapted on time and with the required certainty. Past experience has shown that improving municipal and packaging waste management while banning landfilling will act as catalyst for the management of all other type of waste.

D. Follow up

This initiative is included in the 2013/14 Commission work program (WP 2013/40). The review of the targets responds to the legal obligation to review the waste management targets of three Directives by 2014 – the Waste Framework, the Landfill and the Packaging and Packaging Waste Directives (PPWD). The findings of a fitness check on EU waste five stream directives have been taken into account.

Introduction

This impact assessment responds to the legal obligation to review the waste management targets of three Directives – the Waste Framework Directive (WFD), the Landfill Directive

and the Packaging and Packaging Waste Directive (PPWD)[1] - see **Box 1**. It accompanies a legislative proposal reviewing the targets and including measures to support their implementation. The focus of this review is related to the targets included in the 3 concerned Directives covering municipal waste, packaging waste and construction/demolition waste. Actions to improve the management of these waste – and particularly municipal waste - are considered as catalyst for improvements regarding the other waste streams.

The waste target review is part of a broader process of reviewing European waste policy, the other components being a 'fitness check' of five Directives covering specific waste streams – including the PPWD[2] - and new initiatives following the publication of a Green paper on plastic waste.[3] As explained below, the PPWD is the only Directive covered by the fitness check and by the target review.

Waste legislation was one of the first pieces of environmental legislation put in place at EU level: the first Waste Framework Directive was adopted in 1975, with additional EU texts being adopted since then. In line with the Commission's objective to ensure the "regulatory fitness" of EU legislation[4], this target review offers an opportunity to intensify the Commission's efforts to simplify the existing legislation and reduce regulatory burdens taking on board relevant findings from the fitness check, and taking into account of what has or has not worked.

Under the combined pressure of the expected increase of the world's population and middle class in emerging economies, a massive extra demand strain is expected on primary resources in the coming years. This will drive up the prices of commodities, many of which Europe imports, and may impact on the EU's competitiveness and balance of trade. [5]

In order to face this challenge, in 2011 the Commission adopted two key interlinked strategies: a Communication on raw materials and a Communication on resource efficiency followed by the Roadmap for a resource-efficient Europe.[6] These strategies include clear orientations promoting the use of waste as a resource. This approach has been confirmed in the 7th Environment Action Programme adopted in November 2013 by the Parliament and the Council.[7] The target review process will be guided by the relevant 2020 waste-related objectives of the 7th EAP, namely:

- Existing waste legislation based on a strict application of the waste hierarchy[8] is fully implemented in all Member States;
- Absolute and per capita waste generation is in decline and a comprehensive strategy to combat unnecessary food waste is developed by the Commission;
- High quality recycling is ensured and recycled waste is used as a major, reliable source of raw material for the Union;
- Energy recovery is limited to non-recyclable materials;
- Landfilling is limited to 'non recoverable' waste;

[1] Directive 2008/98/EC of 19 November 2008 on waste, OJ L 312, 22.11.2008, p. 3, Directive 99/31/EC of 26 April 1999 on the landfill of waste, OJ L 182, 16.07.1999, p. 1 and Directive 94/62/EC of 20 December 1994 on packaging and packaging waste, OJL 365, 31.12.1994, p.10

[2] A list of acronyms and abbreviations as well as a glossary is provided in Annex 1

[3] COM (2013) 123

[4] COM (2013) 685 Communication on Regulatory Fitness and Performance (REFIT)

[5] References 17 and 18 in Annex 2 (Part 3/3 of the document)

[6] COM (2011) 25, COM (2011) 21 and COM (2011) 571

[7] Decision 1386/2013/EU of 20 November 2013, OJ L 354, 28.12.3012, p. 171

[8] The waste hierarchy gives the preference to prevention first followed by reuse, recycling before energy recovery and disposal which includes landfilling and incineration without energy recovery

- A quantitative reduction headline target for marine litter is established, which is supported by source-based measures.

These objectives are to be met by 2020 though derogations already granted for 15 MS in the context of the Landfill Directive should also be taken into account – see Box 1.

In order to achieve these objectives and move towards a "lifecycle-driven circular economy, with a cascading use of resources and residual waste close to zero", the 7th EAP calls for a better application of market-based instruments - including extended producer responsibility, for removing barriers facing recycling activities in the EU internal market and for reviewing existing waste management targets. This approach is line with the objectives of the Bioeconomy Strategy aiming at using bio waste streams as resources.[9]

Improving waste management will directly contribute to improving resource efficiency which is a flagship initiative of the EU's structural economic agenda, the Europe 2020 Strategy. A better application of the waste hierarchy leads to new economic activities and creates jobs – most of them virtually impossible to outsource outside the Union. Significant GHG emission reduction could be expected from waste prevention and increased reuse and recycling, while proper waste management can directly reduce litter, especially in the marine environment since for most sea regions, up to 80% of litter is transported there from land by rivers, drainage or wind.[10]

Box 1: Main legally binding targets, review clauses and measurement methods

Article 11.2 of the Waste Framework Directive includes two legally binding targets to be achieved by 2020: a 50% 'preparation for reuse and recycling' target for municipal waste and a 70% 'material recovery' target which includes preparation for reuse, recycling and other material recovery including backfilling operations for construction and demolition waste.

Municipal waste includes waste from households and from similar waste in nature or composition from other producers. As detailed in Commission Decision 2011/753/EU, 4 calculation methods for verifying compliance with the municipal waste targets are allowed:

Method 1: Recycling/preparation for re-use for plastic, metals, paper and glass from household waste;

Method 2: Same as 1 for household and 'similar waste';

Method 3: Recycling/preparation for re-use of all household waste; and

Method 4: Recycling/preparation for re-use of all municipal waste.

Article 11.4 stipulates that by end 2014 at the latest, the Commission should examine the existing targets 'with a view to, if necessary, reinforcing the targets and considering the setting of targets for other waste streams'. Pursuant to Article 9 (c) the Commission should propose by the end of 2014 waste prevention and decoupling objectives for 2020.

Box 1 (continuing)

The Packaging and Packaging Waste Directive includes an overall recovery - covering both packaging material recycling and energy recovery from packaging material - target of 60%, an overall recycling target of minimum 55% and maximum 80% and material based targets of 60% for glass, paper and board, 50% for metals, 22,5% for plastics and 15% for wood.

[9] http://ec.europa.eu/research/bioeconomy/pdf/201202_innovating_sustainable_growth.pdf
[10] Reference 9, **Error! Reference source not found.**

The targets apply to all packaging whether ‘primary’-end consumer packaging mainly collected in municipal waste, ‘secondary’ – grouping packaging or ‘tertiary’ – transport packaging. These targets had to be met by end 2008 with time derogations granted to 8 MS to the end of 2012 and to specified times between the end of 2013 and 2015 for 4 other MS. Pursuant to Article 6.5, these targets have to be reviewed in 2014.

The Landfill Directive requires Member States to reduce biodegradable waste going to landfills on the basis of biodegradable municipal waste produced in 1995. By mid-2006 biodegradable municipal waste going to landfills had to be reduced to 75 % of the 1995 level. By mid-2009 this had to be reduced to 50 % of this amount, and by mid-2016 to 35%. 14 Member States - those which relied heavily on landfilling in 1995 - New MS (except Hungary and Slovenia) plus Greece, Ireland, Portugal and the UK - were given a four year extension period. According to Article 5.2, the targets should be re-examined by mid-2014 in order to ensure a 'high level of environmental protection'. 3 categories of landfills are defined in the Directive – landfills for hazardous waste, landfills for inert waste and landfills for non hazardous/non inert waste – with related acceptance criteria. It is only permitted to landfill waste that has been subject to a 'treatment' as defined in the Directive.

1. PROCEDURAL ISSUES

1.1. Procedural issues

The lead DG is DG ENV. This initiative is included in the 2013/14 work program of the Commission - reference: WP 2013/40.

The preparatory work for this impact assessment started in 2012. An indicative list of issues to be tackled was developed by the Commission and the first interviews with key stakeholders started in February 2013. An online public consultation was launched in June 2013, closing in September 2013. The following DG's participated in the 5 meetings of the Impact Assessment Steering Group: SG, ENTR, CLIMA, JRC, ESTAT.

1.2. External expertise and consultation of interested parties

Several sources of data and information were used to build this impact assessment: first the most relevant reports and evaluations were used to make a pre identification of the success and limits of the EU waste legislation – see Section 2.1 and **Error! Reference source not found.**. This also helped to identify the main problems related to the implementation of the existing legislation and also the remaining gaps. On this basis, a large stakeholder consultation was undertaken and in parallel an 'ex ante' tool was developed to project waste generation and management and their possible impacts.

Evidence base

A consortium led by Eunomia - was used to gather the evidence required to support this IA. In addition to this specific contract, a modelling tool was developed: a first model on municipal waste generation and management was developed by the EEA and then updated and expanded together with the Commission and with the support of the same consortium. Beyond this impact assessment, it is the intention to transform this tool into a permanent 'reference modelling tool' for the EU on waste generation and management to be hosted and regularly updated by the EEA. Unless otherwise specified, the results used in this IA come from this supporting study and from the modelling tool.[11] A summary of the main features of the model is provided in Annex 6. Building on the Eunomia and EEA modelling, additional analytical work, led by Arcadis, was carried out in order to assess the impacts on marine litter of the policy options under consideration – see Annex 7.

Stakeholder consultation

A wide range of stakeholder consultation was undertaken, including:

1. in-depth preliminary consultations of key stakeholders, which was used to ensure that the range of issues raised by the existing Directives, and the options for addressing them, was as broadly-based as possible;
2. an on-line public consultation, including dedicated questionnaires for both technical experts and citizens;
3. a specific seminar focusing on SMEs; and
4. specific consultations on producer responsibility and on marine litter.

The results of the consultation on the Green paper on plastic were also taken into account. As local and regional authorities are key players in waste management, an 'outlook' opinion was solicited by the Commission from the Committee of the Regions.

[11] References 1 to 3 in Annex 2 (Part 3/3 of the document)

More details on the stakeholder consultation process are provided in **Error! Reference source not found.**, detailed result per stakeholder categories of the on line consultation is provided in **Error! Reference source not found.** as well as in the relevant parts of the impact assessment. . In summary, some elements were consistently 'scored' high by most of the stakeholders and were subsequently reflected in the analysis and policy choices including the need to:

- move beyond the recycling targets in the existing Directives while taking into account the large differences between MS in terms of waste management performances (stakeholder views on the level of the targets to be fixed is given in section 4)
- take further measures to restrict landfilling of waste and limit the incineration of waste;
- improve the credibility of statistics, improve reporting and monitoring methods, and improve and clarify existing definitions in the Directives
- simplify and make the targets more consistent
- take additional measures at EU level other than setting targets such promoting the use of economic instruments and developing EU guidance on EPR schemes
- to take measures to promote the use of economic instruments and to further harmonize and encourage optimal producer responsibility schemes (EPR)

The results of the consultations were taken into account (1) to ensure that the main issues and problems in relation with the implementation of the existing targets were properly identified; (2) to narrow the range of options to be considered in more detail in the final stages of the impact assessment; (3) to ensure that the main potential impacts for possibly concerned stakeholder were properly identified and assessed; (4) to 'test' the receptiveness of key stakeholders to some of the proposed options; and (5) to define possible targets for the cost/benefit analysis.

Additional concrete examples on how the results were taken into account will be provided in the relevant sections of this IA. Some proposals emerging from the consultation were not followed such as defining specific additional recycling targets for biowaste, wood, composite packaging or textile, introduce an overall target for prevention or re-use, fixing maximum limits for incineration – see Section 4. There was also a slight majority in favour of targets for waste prevention, but a more considered review of the potential in this regard suggested that setting targets of this nature was difficult given the low quality of data relating to specific waste streams, and the lack of comparability in the reporting of statistics on streams such as municipal waste.

The minimum standards of the Commission for consultation were met.

The positions expressed on waste management by the MS and the Parliament during the negotiation process of the 7th EAP in November 2012-June 2013 were also taken into account. In summary, although the midterm objectives of the 7th EAP relating to waste prevention and management were broadly endorsed, several MS expressed the need to take into account the large differences between MS when fixing new targets.

1.3. Fitness check and ex-post evaluations

Fitness check

As part of the review of EU waste legislation, a "fitness check" (ex post evaluation) of five 'mature' Directives covering specific waste streams has been undertaken, against four main criteria ("effectiveness", "efficiency", "coherence" and "relevance"). On top of the PPWD, the fitness check covers: (1) Directive 86/278/EEC on the protection of the environment, and in

particular of the soil, when sewage sludge is used in agriculture[12]; (2) Directive 96/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT)[13]; (3) Directive 2000/53/EC on end-of life vehicles[14], and (4) Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators.[15] Directives recently adopted or reviewed were excluded from the scope of the fitness check as well as Directives purely related to 'treatment' operations (landfilling, incineration and mining waste operation).

The fitness check and the review of waste targets were conducted in parallel and monitored by the same Commission Steering Group, thus ensuring full coordination between the two processes and a two-way flow of information. As was the case for the waste targets review the fitness check was subject to extensive stakeholder consultation. Taken together the fitness check and the target review provide a comprehensive assessment of the main legal instruments in the field of waste management.

Ex-post evaluations

As explained in section 2.1 below, several sources of data and information on what appears to have worked or not worked are available on the targets of the Waste Framework and the Landfill Directives. This includes notably an ex post evaluation carried out by the EEA in the context of a 'pilot project' on better implementation, a Communication of the Commission evaluating the added value and remaining challenges related to the Thematic Strategy on Waste Prevention and Recycling, additional 'on the field' information gathered during a recent compliance promotion exercise aiming at disseminating best practices amongst the less advanced MS and recent reports on the implementation of the waste legislation published by the EU Court of Auditors and the European Investment Bank (see section 2.1).

All these sources of information have allowed a clear picture to be gained of the main barriers preventing MS from making progress but also on the key instruments to be put in place to improve their waste management. It has also already allowed the Commission to propose 'Roadmaps' to the 10 MS whose performance is weakest, including a list of recommendations to improve their waste management situation. These Roadmaps were discussed during seminars in each of the 10 identified MS and additional seminars are already programmed with other less advanced MS.[16]

1.4. Recommendations of the Impact Assessment Board

A draft of this Impact Assessment was submitted to the Impact Assessment Board on 19th February 2014. In its first opinion, the Board made recommendations for improvements which were included in a revised version. This revised version was submitted to the Board on 28th February 2014. In its second (positive) opinion, the Board made additional suggestions to improve the report.

In summary, the recommendations included in the first Board opinion were taken into account as follows:

(1) Improve the problem definition and clarify the baseline

The economic rationale for waste recycling has been strengthened in the problem analysis (section 2.5.1) and the analysis of the impacts (section 5.1.1).

12 OJ L 181, 4.7.1986, p. 6–12

13 OJ L 243, 24.9.1996, p. 31–35

14 *OJ L 269, 21.10.2000, p.34*

15 OJL 266, 26.0.2006, p. 1-14

16 More details including the country specific Roadmaps are available from the following web site: http://ec.europa.eu/environment/waste/framework/support_implementation.htm

References to and relevant findings of the fitness check have been included in new sections (sections 1.3 and 2.2) as well as in other parts of the text when relevant. The effectiveness of the EU targets - including the given time derogation to some MS - is discussed in sections 2.1 (ex-post evaluation) and the new section 2.2 (main lessons learnt from the fitness check). The main difficulties of the few MS not meeting the current targets and more generally of the poor performing MS are summarised in introduction of section 2.5 on the causes of the problem. The problem definition has been clarified notably by renumbering the sections related to the causes of the problem. More emphasis has been given to issues related to governance on the basis of a better explanation of the measures having contributed to the success of the more advanced MS (section 2.5.1). The necessity to fix midterm targets is better explained in sections 2.5.1 and 4.4 in introduction of option3.

Additional data expressed in terms of kg of waste per inhabitant not recycled have been included in section 2.4.

(2) Clarify the proposed options

In section 4.4 additional efforts have been made to better explain how the diverging MS waste management performances has been taken into account when fixing new targets and on what basis the targets have been set. In the same section, it is explained why the targets should be set at the same level for all MS despite differences in waste generation and why these targets are considered as feasible and realistic without applying any time derogation. Subsidiarity aspects of limiting landfilling at EU level are further discussed in section 2.8. The content of Option 2 is clarified in section 4.2 by better explaining the practical measures to be taken to implement the proposed actions. The relationship and coherence between the targets and the proposed measures is further detailed in sections 4 and 6.3. Options have been renumbered following the suggestion of the Board.

(3) Improve the assessment of impacts

A more clear reference to the cost and benefits associated to each treatment technology is provided in Section 5.1 and in **Error! Reference source not found.** and additional explanations are provided in the high costs associated with the full implementation scenario in Section 5.2. Distributional impacts among different MS are further detailed in Section 5.2 and additional data on raw material access is provided in Section 6. Additional efforts have been made to try to quantify the impacts of the proposed measures on administrative burden – see Section 5.2. Additional explanations have been included in Section 6 on the formulation and the weight of the criteria for comparing the options and the main challenges linked with the implementation of the proposed measures have been identified in the same section as well as how they can be addressed.

(4) Better present stakeholder views

The different stakeholder views have been detailed particularly regarding the type and the level of binding targets and more details have been included on how the stakeholder views have been (or not) taken into account (Sections 1.2, 4 and Annex 3). A new Annex has been added (Annex 4) with the detailed results of the on line stakeholder consultation summarising for each question the position of the main stakeholders groups. A summary on how stakeholder views have been taken into account has been inserted in section 1.2.

In addition, the recommendations of the Board on the presentation of the report were also followed, for instance the sections on the current targets and the present situation was simplified and the options were presented in a more intelligible way for a non expert reader. Additional improvements have been included at several places of the document following the technical comments provided by the Board.

The recommendations of the second Board opinion were taken into account as follows:

(1) Clarify the problem definition and the need for new midterm targets

Additional explanations on how setting new upgraded midterm targets for 2030 will address some of the problems identified (governance, lack of public awareness, lack of use of appropriate economic instruments) were included in section 6.4.

In section 2.5.1 the relation between the economic conditions and how the targets were fixed in the past is better explained though in section 4.3 the link between the need of targets and the economic rationale is developed. The main reasons for not proposing new overall prevention targets were detailed in section 4.3.

(2) Improve the options

Additional justifications for introducing landfill bans at EU level from the subsidiarity and proportionality point of view were inserted in sections 2.8 and 4.3.

The main reasons for rejecting the option of country specific differentiated targets were better substantiated in section 4.3. This includes additional explanations on the possible effects on recycling potentials of divergent municipal waste composition between Member States.

The practical implications of imposing a landfill ban on all similar waste were detailed in section 5.2. Additional information on how the problem of illegal landfilling will be addressed is provided in section 6.4. In section 5.2 it has been clarified whether additional impact assessments would be achieved for the proposed delegation given to the Commission for defining technical requirements (National registries and third party verification).

(3) Elaborate the assessment of impacts

In section 6, the options have been compared in terms of efficiency and coherence. The feasibility of the proposed targets for all MS was further discussed in section 4.3 and 6.4. The views of the less performing Member States on waste management were better reflected in section 4.3. Additional information on the impacts on the Member States of the different scenarios was added in section 5. Additional explanations were provided on the costs and revenues from recycled materials as well as on the quality of the materials and its faculty to compete with virgin raw materials (section 2.5.1).

(4) Procedure and presentation

The differences between sub options 3 were better explained and option 3.7 was included in the summary overview in section 4.3. Additional explanations were inserted in section 5 on how the impacts of the sub options were estimated. Stakeholder views with regards to some proposed compulsory measures were detailed in section 4.2.

In addition, some factual mistakes were corrected notably for what relates to the assessment of the impacts of the proposed options on marine litter.

2. POLICY CONTEXT, PROBLEM DEFINITION AND SUBSIDIARITY

This section first summarises the main lessons learnt from the most relevant reports evaluating ‘a postiori’ (‘ex-post’ evaluations) how the EU legislation has functioned so far. A massive flow of data and information is available notably on the management of municipal

waste, on the main reasons for success and failure to implement the waste hierarchy and for meeting or not the EU targets. This information has been completed on one side by the recent compliance promotion exercise undertaken by the Commission and by the main conclusions from the fitness check on the PPWD. In the second part of this section, the main available statistics on waste management are summarised and compared to the EU targets.

2.1. Ex-post evaluation

Achievements and remaining challenges

In preparation of this impact assessment, several analyses have been undertaken to evaluate the added value, strength/weaknesses of the existing legislation:

1. In 2011, following a large stakeholder consultation, the Commission adopted a report evaluating 'ex post' whether the objectives of the Thematic Strategy on the Prevention and Recycling of Waste are met or not, including the attainment of the main EU targets.[17] The report highlighted the progress achieved in terms of landfill reduction and increased recycling at EU level and the role of EU wide quantitative targets. These targets were considered by the stakeholders involved in the review process as one of the key drivers for improving waste management in the EU.

   Remaining challenges in terms of waste prevention as well as in terms of the persistence of large difference between MS were also identified. For each waste related Directive, MS performances were compared to available statistics and EU targets demonstrating that some MS will have to make additional efforts to meet the targets. Several recommendations were made including promoting measures to improve the implementation of existing targets notably by developing an 'early warning' procedure, to ensure a proper use of key instruments by MS such as economic instruments and to improve the use of regional funds. More ambitious targets were also recommended to move towards a 'recycling society' – one of the key objectives of the Thematic Strategy. The necessity to improve knowledge on waste management, notably through improved statistics, was also highlighted.

2. As one of the results of a 'pilot project' launched between the Commission and the EEA to improve the implementation of key Directives, in March 2013 the EEA published a report assessing 'ex post' the progress achieved on municipal waste management.[18] This report includes an in depth analysis of MS performances which were used in the context of this IA. In the conclusions of the report, the effectiveness of targets in driving change was made clear, but large differences between MS performance were highlighted, showing that European targets are necessary, but not sufficient, to drive improved outcomes. This is notably the case for the Landfill Directive for which the report mentioned "The Landfill Directive's differentiated, incremental approach to target setting, including intermediate and long term targets, seems to be a valuable template for EU initiatives. It has enabled biodegradable municipal waste landfill diversion to be planned in a gradual fashion, allowing improved waste management systems to be developed".[19]

   Additional Regional and National initiatives are necessary to meet the targets and a clear correlation between the use of a combination of key instruments and MS performances was demonstrated. These instruments include appropriate waste management planning, use of economic instruments such as landfill taxes or pay-as-you-throw schemes, and mandatory separate collection of certain waste fractions. The report also insists on the need to improve the quality of statistics and reporting thereof.

[17] COM 2011 (13), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0013:FIN:EN:PDF
[18] Reference 7 in Annex 2 (Part 3/3 of the document)
[19] Reference 7 in Annex 2 (Part 3/3 of the document)

3. In 2011/2012; following the publication of the report on the Thematic Strategy, the Commission took the initiative to promote compliance with waste legislation with a focus on municipal waste management. A 'scoreboard' classifying MS according to several criteria related to their waste management performances was established.

   The quality and adequacy of the waste management plans was amongst others assessed for all MS. This assessment revealed that quantitative targets are used by the vast majority of MS and Regions as the main basis for establishing waste management strategies. Without clear quantitative waste management objectives, it is indeed difficult or even virtually impossible for these MS or Regions to deliver a consistent and solid planning of the required infrastructures. In that context, the European targets are recognised and used as the basis for the vast majority of the National or Regional waste management plans.

   For the 10 weakest performing MS an in depth 'ex-post' analysis has been undertaken and summarised into a 'factsheet' including key strengths and weakness of their waste management system. Then a 'Roadmap' including key recommendations to improve waste management and to meet the minimum targets was issued for each MS.

   These documents were discussed with the relevant national authorities in the 10 MS during ad hoc seminars. The final report[20] published in April 2013 includes recommendations to meet the EU targets notably on how to improve statistics, better use of economic instruments, development of the required infrastructures and separate collection, and improving governance. Some MS have already revised their National waste management plans and strategies in response: for example, Greece, Poland and Czech Republic where the introduction of new economic instruments - mainly landfill taxes has been announced. A systematic follow-up of these seminars is planned at Commission level as well as the extension of the exercise to at least 4 to 7 additional MS.

4. The European Court of Auditors[21] published a report in 2012 on the use of Regional funds for municipal waste management. The Court recommended the promotion of source separation of waste and the development of related infrastructures, a better application of the landfill Directive, the imposition of conditions before granting funds to the MS notably in terms of use of economic instruments such as landfill taxes and a broader application of the polluter pays principle, the setting up of reliable waste management databases by the MS, improvements to the regulatory framework including the development of prevention targets, a clarification of some key definitions and the dissemination of best practices. The report also highlights the fact that EU Structural funds have been utilised in recent years with a too heavy focus on the management of residual waste. These investments have contributed towards achieving targets to reduce the amount of biodegradable municipal waste landfilled, but if they become the focus of activity, they risk undermining the potential for capturing the value of materials in the waste stream, and limiting the potential for mitigation of climate change through improved management of waste.

In conclusion, most of the ex-post evaluations and reports highlighted that for the vast majority of the Member States and operators active in waste management, European legislation and particularly the setting of legally binding targets, has been a key driver to change waste management practices. For a small number of front running MS, EU legislation was not considered as the only key driver as most of the policies necessary to achieve the targets were already in place (if, indeed, the targets themselves had not already been achieved) by the time they were adopted at EU level. But even for those few MS the creation

[20] Reference 6 in Annex 1 (Part 3/3 of the document)
[21] Reference 13 in Annex 2 (Part 3/3 of the document)

of an EU wide waste market was important for instance to develop new recycling activities based on EU wide waste streams.

Quantitative waste management targets are indispensable to establish robust and action-oriented waste management plans and to foresee, sufficiently far in advance, the required infrastructure and efforts, for instance in terms of separate collection. Without practical and measurable targets, these plans remain vague and risk not acting as a driver for real change. Apart from few front runner MS, **European targets** remain **the reference** for nearly all MS to establish their waste management plans.

Time derogations were given nearly exclusively to MS that joined the European Union more recently as time was needed for these countries to set up new infrastructures and new ways of managing waste (as it was the case for the other MS). As detailed in section 2.3, time derogations were an effective tool to ensure a realistic implementation of the EU targets.

2.2. Fitness check – main lessons learnt

As noted in section 1.3 above, as part of its review of EU waste legislation, the Commission has conducted a "fitness check" of five waste stream directives including the PPWD. The (preliminary) findings[22] - based on in-depth literature review and extensive stakeholder consultation - indicate that the assessed directives are essentially 'fit for purpose'.

Turning to the PPWD more specifically, it is worth noting that, as regards its effectiveness, the recovery and recycling targets set out in the Directive have been met by nearly all MS, with a significant increase over the past 15 years (e.g. packaging waste recovery rates increased from 53.7% in 1998 (EU15) to 77.3% in 2011 (EU27) and recycling rates from 47.3% to 63.6%). Under the coherence criterion the fitness check identifies a number of differences between definitions in the PPWD and those in the Waste Framework Directive. This concerns for instance the notions of 'prevention', recycling', 'reuse' and 'recovery' (see Annex 9). Other issues identified by the fitness check concerning the PPWD include the need to repeal some obsolete requirements, the effectiveness of producer responsibility systems, the reliability of statistics, and the relation between separate collection systems and the quality of the recyclable materials.

Finally, stakeholder consultations conducted in the context of the fitness check revealed the following mainstream views for the PPWD:

- There is broad consensus to maintain separate targets in the PPWD, rather than integrating targets into the WFD or splitting them according to their origin (end-consumer, commercial or industrial)
- There was overwhelming support for more harmonisation, the development of clear technical requirements and statistical standards, and for the PPWD to include more legally binding language on the producer responsibility principle.

These conclusions as well as other findings from the fitness check are reflected in those parts of the IA relating specifically to the PPWD.

Other general conclusions of the fitness check shows that the 5 Directives – have achieved their main objectives (as regards resource efficiency, protection of the environment and human health, harmonisation of the internal market) and targets (as regards recovery, recycling and reuse)[23], at reasonable costs. They are generally speaking consistent with each other and the broader EU waste acquis, even though some aspects of these (older) waste

[22] The fitness check's final findings will be summarized in a Commission Staff Working Paper to be published as part of the Commission's overall waste review package.

[23] A (partial) exception is the PCB/PCT Directive which suffers from a persistent implementation gap by MS.

stream directives would benefit from an alignment to the (more recent) Waste Framework Directive (e.g. as regards the five step waste hierarchy, life-cycle thinking, extended producer responsibility provisions and certain definitions). The fitness check also concludes that the directives remain a relevant pillar of the EU's overall waste policy - with the possible exception of the Sewage Sludge Directive (dating from 1986) which is considered largely outdated - while suggesting a number of elements for their further evolution (e.g. more emphasis on prevention and re-use; addressing challenges triggered by new materials; eco-design considerations etc).

2.3. Progress achieved & implementation of existing targets

Progress has been made during recent years to improve waste management in the MS even though EU averaged data masks significant differences between MS.

Table 1 below summarised the main existing target in the European legislation and how MS are meeting or not these targets. More details are given on the attainment of each target by each MS in Annex 4. In summary, **only a limited number of MS are at risk of not meeting the existing targets** without additional efforts. Most of the MS have either exceeded the existing targets (sometimes by a significant margin) or are expected to meet the current targets by the date to which the target applies. Today **no infringement procedure is open** for non-attainment of any of the European targets covered by the present review. Nevertheless, additional information has been requested from a few Member States on the measures they intend to take to ensure that the targets will be met on time. This concerns particularly the landfill diversion target.

Generally speaking, the **EU legislation has driven changes** in waste management in the MS. This is particularly true for the packaging waste and the landfilling of biodegradable waste: as detailed in the fitness check and in Table 1 below, the recovery and recycling targets set out in the PPWD have been met by nearly all MS. Overall recovery and recycling rates have increased since the adoption of the Directive (e.g. packaging waste recovery rates increased from 53.7% in 1998 (EU15) to 77.3% in 2011 (EU27) and recycling rates from 47.3% to 63.6%). Similarly, 23 MS are on good track to meet the landfill diversion target and landfilling of biodegradable waste has decreased in all MS following the introduction of the landfill Directive targets in 1999 (see **Error! Reference source not found.** and **Error! Reference source not found.** in **Error! Reference source not found.**).

Increased recycling rates for packaging waste (of which a part is municipal waste) and diverting biodegradable waste from landfilling have both influenced municipal waste management in the right direction: municipal recycling rate in 2011 amounted to 40% - an increase of 8 percentage points compared to 2005. Waste incineration has increased from 95 kg per capita in 2005 to 111 kg in 2011 of which 89kg/inhab might be considered as ‘energy recovery’. At the same time, landfilling of municipal waste has decreased from 65% in 1995 to 49% in 2005 and 36% in 2011. In addition to the influence of the landfill diversion target, this reduction of landfilling seems also linked with social acceptance considerations: as detailed in section 2.5.1, EU citizens are less and less prepared to accept landfilling as a way to treat waste. Half of the 31 open infringement cases for bad application of the waste Directives are related to illegal landfilling or non-compliant landfills. Several petitions hare open or have been treated by the EU parliament on the same issue.

As detailed in Table 1 below, the vast majority of the MS will be able to meet the municipal waste and the construction and demolition waste targets by 2020. As the targets of the WFD were adopted in 2008 (and transposed into national legislations in 2010), it is too early to conclude on the influence of the targets on MS performances for these two specific targets. Whilst recycling rates vary from one waste stream to another, overall waste recycling in the EU has increased: in 2008, waste recycling was estimated at 36,5% (2011) – 38,5% -

indicates a slight increase of 2 percentage points of the overall recycling rate. Less waste was sent to landfill: 36% in 2011 compared to 49% in 2005 and 62% in 1995.

For what relates to prevention, progress have been more limited: at EU-27 level, total annual waste generation decreased by 5% between 2006 and 2010 due to the impacts of the economic crisis, the change in the structure of the economy - shifting towards a more service-based economy but also changes in reporting methods. It is difficult to isolate the possible effect of measures taken to favour waste prevention, or the 'dematerialising' of some consumption - for example, music being downloaded digitally. In most MS total waste generation appears to be stabilising in the long run.

Municipal solid waste generation has now stabilised since the years 2000 around 500 kg per year and per capita in the EU-27. There is a relative decoupling with consumption - which increased by 16.3 % between 1999 and in 2007. Large differences persist between MS - from around 300 to 700 kg per capita - which seem to be due not only to different consumption levels and patterns, but also, the varying scope of wastes being reported as 'municipal waste' by MS – see section 2.5.2.

Table 1: Attainment of EU targets – summary

	Target	Attainment of the target – summary
Municipal waste preparation for reuse and recycling	50% by 2020	Target can be met for all MS only if the 4 measurement methods are allowed
Construction& demolition waste 'material' recovery	70% by 2020	2/3 of MS will meet the target in the short term. Other MS should follow before 2020
Amount of biodegradable waste sent to landfill (basis = 1995), 14 MS without time derogation	50% by 2009, 35% by 2016, or 50% by 2013, 35% by 2020 (14 MS with time derogation)	23 MS are on track to meet the targets. Additional efforts required for 5 MS
Overall recycling target PPWD	55% by 2008 16 MS with time derogation until 2016	21 MS have met the target, the remaining MS are expected to meet the target on time

On the basis of the achievement of the most advanced MS, and in line with the conclusions of the fitness check, it is clear that further progress beyond the 2020 targets are feasible for recycling and reuse of household/municipal waste and for reducing waste sent to landfill, but also, before 2020, for recycling packaging waste.

2.4. Problem definition

Loss of valuable materials

Today, a significant amount of potential secondary raw material is lost to the European Union's economy due to due to the fact that waste is not managed as well as it could be. In 2010 total waste production in the EU amounted to 2,520 million tons[24], an average of 5 tons per inhabitant and per year.

[24] Source: Eurostat 2013

Figure 1 shows that from this total only a limited share – 36% or 1,8 ton per year and per inhabitant - was effectively recycled. The largest share – 37% or 1,9 ton per year and per inhabitant was simply sent for disposal whether in landfills or on lands (16% of the total) - or in areas designated for the storage of mining waste (21% of the total). The remainder was either backfilled - 10% or 0,5 ton per year and per inhabitant, untreated 6%, incinerated 6% of which 4% with energy recovery, the remaining 5% or 0.25 ton per year and par inhabitant being disposed otherwise. In other words, around 1620 million tons of waste was lost for the EU economy; even if, under current technical conditions not all this waste could have been avoided, reused or recycled. All in all, the remaining potential for recycling/reuse could be estimated at maximum 600 million tons if mining waste is excluded as well as soils, what is energy recovered or sent to backfilling.

In 2011, municipal waste represented around 253 million tons or around 500 kg/year and per inhabitant of which 62% (or 157 million of tons, or 310 kg/year/inhabitant) was not reused or recycled.

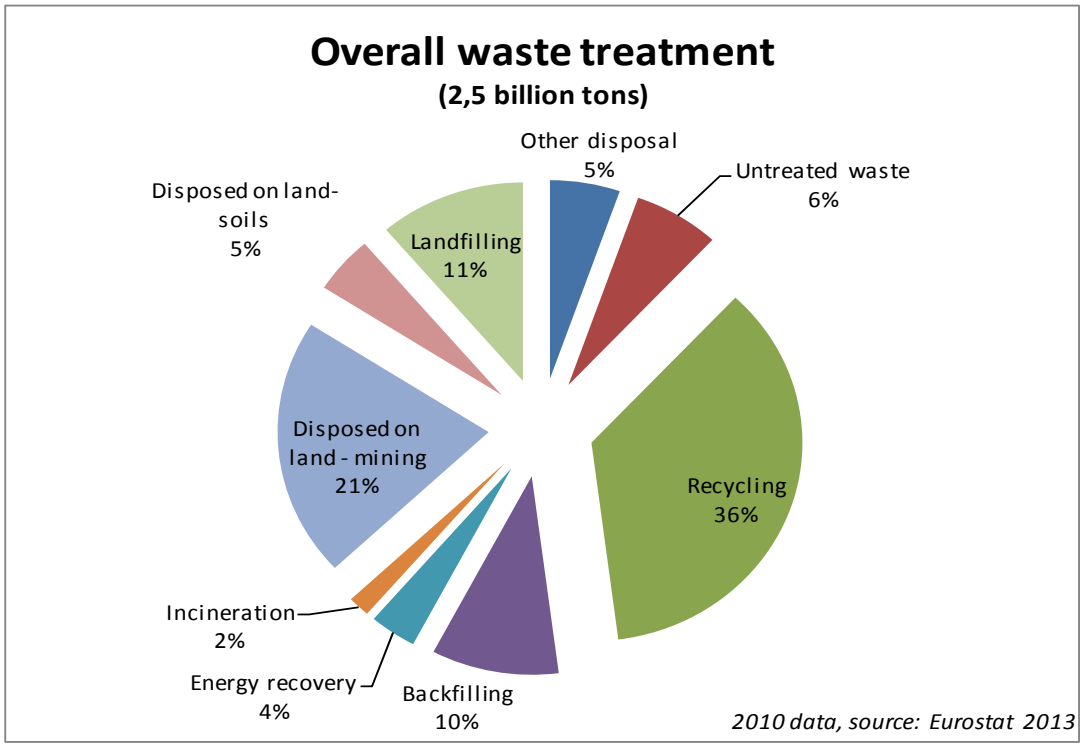


Figure 1: Overall waste treatment, Eurostat 2010

Packaging waste amounted to 80 million tons of which 36% (or 29 millions of tons) were not reused or recycled. Construction and demolition waste amounted to 860 million tons in total of which 350 million tonnes of mineral waste – of which 19% or 64 million of tons was not recovered, the rest consisting of excavated soils. These losses of valuable materials prevent the creation of a 'circular economy' aimed at keeping resources within the economy and using waste as the input material for new products.

Missed opportunities for growth and jobs

Losing this material means that significant growth and competitiveness potential is not being exploited through the development of a reuse/recycling industry in the EU: in 2008 waste management and recycling industries in the EU had a turnover of €145 billion representing around 1% of the EU's GDP and generating 2 million direct jobs. European firms have also used this as a base from which to expand and take up strong positions in the growing global markets for waste management. Compared to 2008, full compliance with EU waste policy in the coming years could create an additional extra 400.000 jobs and an additional annual

turnover of € 42 billion.[25] Moving towards the objectives of the Roadmap on Resource Efficiency could help to create 526.000 jobs and an additional turnover of € 55 billion.

Competitiveness and EU dependency on raw material

In addition to this midterm stimulus, increased reuse and recycling can pump resources back into the economy and ensures an at least equivalent, often cheaper and more reliable access to raw materials - some of them considered as 'critical' - which are indispensable for EU industrial competitiveness. Raw materials are considered as essential for the EU industry: at least 30 million jobs depend on access to raw materials. [26]

Materials are one of the most important input costs of European manufacturing companies making up around 30 to 40 per cent of the sectors' cost structures. [27] The EU is not self-sufficient in many resources including for critical raw materials.[28] Globally, the Union imports six times more materials and resources than it exports. For some of these materials, the import dependency is significant. [29] On average, real prices increased by more than 300% between 1998 and 2011 for resources – see Figure 2. In general, the prices of commodities are expected to rise due to the expected increase of the resource demand.

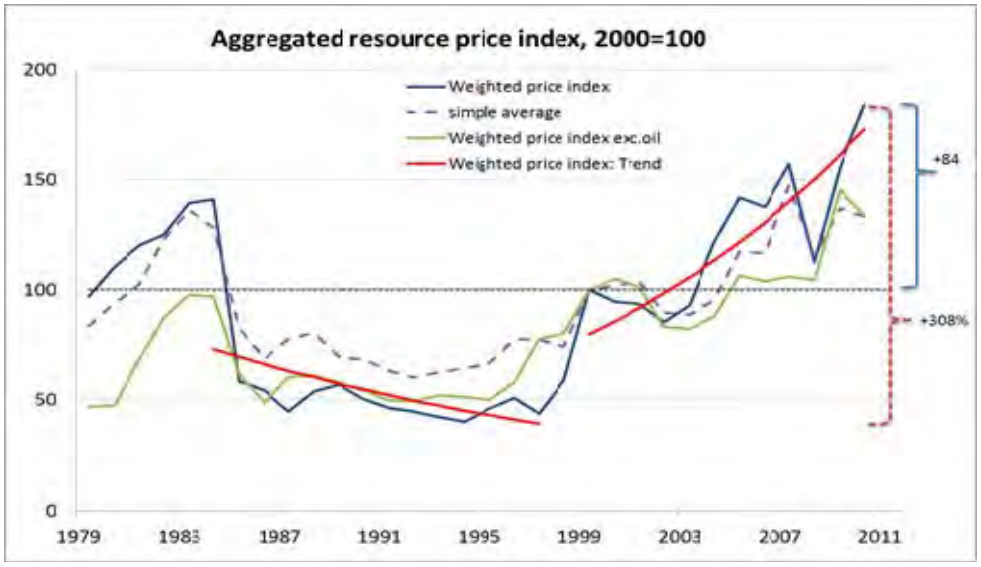


Figure 2: Overall resources price evolution 1979- 2011 [30]

Energy and GHG emissions, air pollutant emissions

Improved waste management can help reduce greenhouse gas emissions directly by cutting GHG emissions from landfills and indirectly by recycling materials which would otherwise be extracted and processed. These reductions could occur either within or outside the EU depending on where the secondary raw materials are used as input to manufacturing processes. Generally speaking, recycling material is far less energy demanding than extracting, processing and transporting virgin raw materials. For example recycling aluminium requires 5% of the energy needed to extract and process bauxite leading to major efficiency and competitiveness gains and reducing dependence on imported material. As detailed in the fitness check, the level of packaging recovery and recycling achieved by 2004

[25] Source: Annex 2, reference 10 (Part 3/3 of the document)
[26] Source : Note of the interserevice group set-up by BEPA on Raw materials – November 2013
[27] Source: reference 17, in Annex 2 **Error! Reference source not found.**
[28] As defined under the EU Raw Materials Initiative.
[29] 100% for platinium, cobalt, most rare earth, 85% for iron ore, 57% for metals and 46% for industrial minerals
[30] Source: reference 19, Annex 2 (Part 3/3 of the document)

corresponds to about 10 million tonnes of oil equivalent and 25 $MtCO_2$-equivalent compared to a scenario where all packaging waste would be landfilled or incinerated.[31]

Compared to 2004 emissions, it has been estimated that between 146 and 244 Million tons of GHG emissions could be avoided by 2020 through reinforced application of the waste hierarchy[32] representing between 19 and 31% of the 2020 EU target. Similarly, significant air pollutant emissions can be avoided: as with GHG emissions, indirect emission savings linked with increased use of recycled material would also take place, either within or outside the EU depending on where the secondary raw materials are used.

Other impacts

Improper waste management can have direct consequences at local level such as landscape deterioration due to landfilling, local water and air pollution, etc. Inappropriate behaviour related to waste management is also one of the causes of littering leading to significant costs, both direct (e.g (beach) clean-up costs and damage to fishing vessels and fishing gear, especially in the marine environment) and indirect (e.g. loss of property value and tourism potential in affected areas). In addition, the accumulation of non-biodegradable waste –plastic waste in particular - in the oceans has negative consequences on marine biodiversity and ultimately, for those who consume fish.

2.5. What are the underlying causes of the problem?

As summarised in Table 2, improper waste management is due to a combination of causes. Some of these relate to the adequacy of EU legislation, others to governance issues particularly in MS with poor performances in terms of waste management.

There are **significant differences** between the MS and also between regions within MS in terms of waste management practices - see Figure 3. This uneven level of performance is partly linked to the time needed for constructing the required infrastructure, developing at source separate collection systems, ensuring appropriate information and building the necessary competences from the local to the national levels. This is particularly valid for MS having joined the Union more recently but also for some other MS.

Some MS have not given enough priority to improving waste management. Generally speaking, in the less advanced MS the main difficulties are related to a combination of factors including problems of governance illustrated for instance by the absence of coordination between the National and the Regional or local authorities, the lack of public awareness including amongst the decision makers, the lack of use of appropriate economic instruments making low performing option such as landfilling cheaper. These MS have often low performing EPR systems in place making the launching of separate collection more complicated and at full costs of the public authorities. The absence of midterm targets for the European Union complicates their task as they are tempted to invest in infrastructures aiming at just meeting the current targets without forwarding vision.

[31] Source: Annex 2, reference 26 (Part 3/3 of the document)
[32] Source: Annex 2, reference 12 (Part 3/3 of the document)

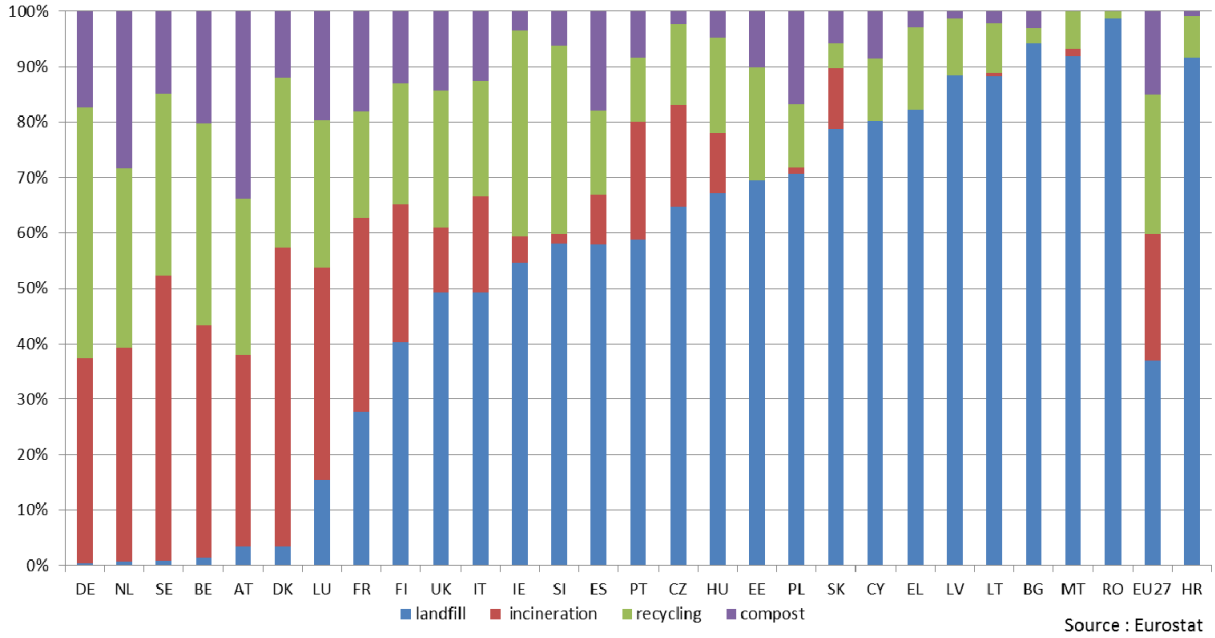


Figure 3: Municipal waste management in 2011[33]

This IA focuses on the causes on which EU action can have a positive influence. For instance, issues related to governance can be partly solved through dissemination of best practices including the use of economic instruments to favour prevention, recycling and reuse: for instance landfilling often remains the least costly option which is detrimental to the creation of 'circular economy'. As also highlighted in the fitness check for the PPWD, the existing waste legislation could be further simplified which will help to ensure proper implementation. Monitoring MS performances can be simplified and improved in a more proactive way.

And even if all existing targets are met on time by all MS, there will remain a gap between the EU aspiration of improving resource efficiency and being less dependent in terms of access to raw materials and MS waste management performances.

Nature of the problem	**Loss of valuable resources for the EU economy due to improper waste management**
Causes	**Issues related to Governance** ➢ In some MS, lack of administrative capacity and coordination between local/regional and national competences ➢ Lack of economic incentives and sub optimal EPR schemes ➢ Inappropriate use of Regional funds
	Monitoring Issues Uneven quality of statistics Late reaction in case of risks of non-attainment
	Issues related to the EU legislation Lack of mid-term targets leading to sub optimal investments Unclear definitions, obsolete requirements Overlaps in targets, ambiguous measurement methods
	Gap existing targets vs EU vision ➢ Distance between current targets and EU 2020 strategy, Raw material initiative, 7th EAP

Table 2: Links between problem definition and causes of the problem

2.5.1. Issues related to governance

In this section the main success factors of the most advanced MS are identified and by contrast what is lacking in the less advanced MS is illustrated. This relates mainly to the use

[33] Source: Eurostat 2013

of economic instruments which are vital to meet the targets but also to a proper organisation of separate collection and an appropriate use of structural funds. Issues related to social acceptance are also discussed at the end of this section.

Economic conditions

As pointed out in several reports including in the conclusions of the fitness check, and by the Court of Auditors, key instruments and particularly **economic instruments** are essential to support the development of the required infrastructure: the experience of the most advanced MS has shown that appropriate economic instruments are indispensable to meet the European legally binding targets and more generally speaking, to create a sustainable recycling industry.

As illustrated in Figure 2, prices of primary raw materials - which influence the prices of secondary materials - fluctuate over time depending on the balance between supply and demand:

- For some materials, for which price levels have been consistently high, the case for separate collection, sorting and recycling will remain strong regardless of these fluctuations. This is, for instance, the case for some metals, such as copper or aluminium;
- For other materials such as plastic bottles or paper/cardboard, these market fluctuations will directly influence the economic case for sorting/recycling operations. In some years, the sales of the recycled material will be higher than the costs of collecting and sorting the material, in other years it will not be the case;
- For a last category of materials, the value derived from the sale of recycled materials is not high enough to ensure that the costs of separate collection, sorting and recycling are lower than the costs of dealing with the material as part of residual waste. This is the case for instance for plastic films from the municipal waste stream, for which market prices are low, and so the proportion of the material being recycled is also low.

Existing targets in the waste legislation are not linked to these 3 categories of materials. They were fixed for priority waste streams from the environmental point of view but also on the basis of consistent and identifiable waste streams (for instance collected and treated together) and for which enough data were available. The 3 categories of material are present in all these waste streams. In addition, fixing targets on the basis of these categories would not make sense as recycled material prices are fluctuating therefore some materials are changing of category sometimes in few weeks.

The quality of the materials collected and sorted has also a direct influence on their markets and on their prices: source separation of waste provides materials of better quality and higher price. Obviously collection costs tend to increase but it is more than compensated by the sales of materials and additional savings on the collection and treatment of mixed waste. This is further detailed in section 5.1.

Obviously, weak demand and market price fluctuations present issues for potential investors in recycling activities, including public operators: public funds are usually based on annual budgets which are not adapted to market fluctuations. Partly for this reason, public authorities are often somewhat less interested in material revenues than perhaps they should be.

Market fluctuations and low prices for some recycled materials represent clear barriers for a broader development of recycling activities. In the most successful MS, key economic instruments have allowed to create more favourable economic conditions for recycling.

These key instruments include: progressive **landfill/incineration taxes** often followed by bans on certain type of waste, **extended producer responsibility schemes** (EPR) transferring the costs of separate collection, sorting and recycling to those placing products on the

markets, **"pay-as-you-throw"** (PAYT) schemes making citizens/companies directly financially responsible for the 'unsorted' waste they generate and **systems of subsidies/charges** to favour the development of separate collection and reuse/recycling by the competent local authorities - mainly the municipalities. These conclusions are valid for all recyclable waste including packaging waste as shown in the fitness check.

Figure 4 shows for instance the relationship between landfilling rates of municipal waste and the total landfill charge including fees and taxes in the Member States. As expected, there is a direct influence of the landfill price on the landfill rates: poor performing MS have all landfill charges below 50-60 € per ton. On the contrary, MS with lowest landfill rates having all progressively increased their landfill taxes some of them having supplemented this approach by the progressive introduction of landfill material based bans. Similar correlations exist between landfill and incineration charges and recycling and composting rates.

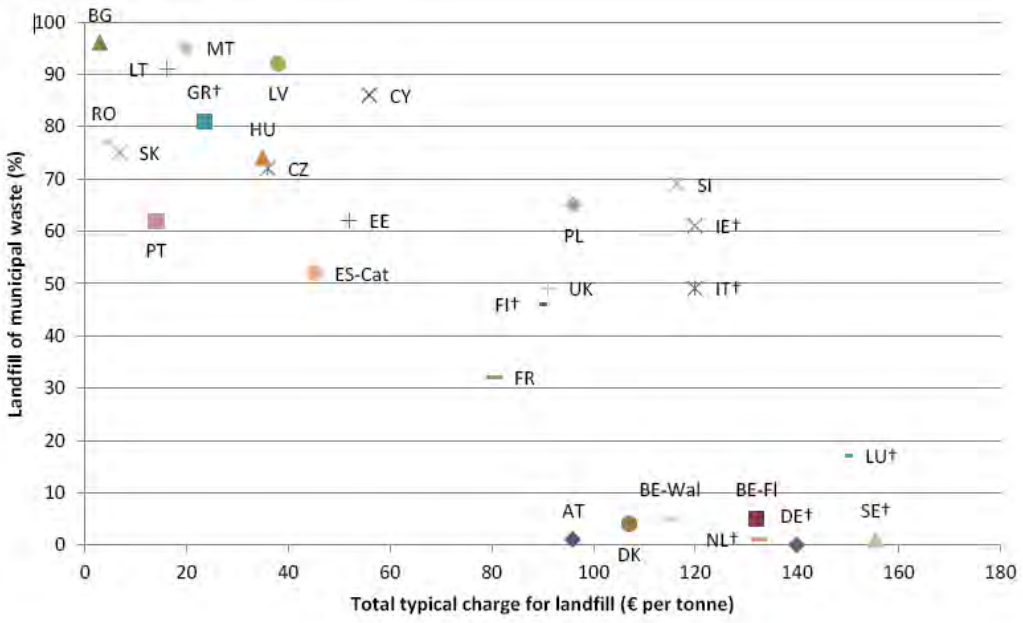


Figure 4: Municipal waste landfilling and landfill costs [34]

Similarly there is a large variety of **extended producer responsibility** (EPR) schemes in the MS notably in terms of waste covered by EPR schemes: most advanced MS have developed EPR systems for several types of waste streams. As illustrated in the fitness check for packaging waste, these **EPR schemes are extremely important to unblock the possible barriers for the development of separate collection**.

Properly managed EPR schemes can provide the required funds to help municipalities to launch separate collection and sorting operations but also to cover the recycled materials price fluctuations. EPR mechanisms where the producers essentially take one the risks associated with material price fluctuations (such that producers themselves, in supporting the scheme financially, pay lower fees when material process are high, and higher fees when material prices are low). Such approaches can help insulate public authorities from the vagaries of market price fluctuations, and for producers, they pay higher fees at times when they themselves may be beneficiaries of lower market prices for materials which they use.

The variety of EPR schemes between MS also concerns the rules applied for the control of the schemes, the level of 'free riders' – importers or producers not participating in the systems, relations with the municipalities, and transfer of the whole and true costs to those placing goods on the market (producers/importers).

[34] Source: reference 4 in Annex 2 (Part 3/3 of the document) and fitness check

This has led to differences in terms of cost effectiveness but also to divergent conditions imposed on those placing products on the EU market. Generally speaking, the most efficient EPR schemes are those based on a clear definition of the responsibilities of the involved actors and a permanent dialogue between these actors. [35]

As shown in the following Figure, the best performing schemes are not necessarily the most expensive. Comparisons between the schemes remain difficult as data are not always easily available, there is a lack of transparency; some schemes only cover household packaging, others only commercial and industrial packaging, others both types of packaging waste; some schemes like in the UK, France or Romania do not cover the whole collection and treatment costs of waste packaging. Other elements could also justify this differences of costs/fees paid like geographical conditions (AT) or differences in labour costs. Nevertheless, as shown in Figure 13, a margin of progress in terms of cost effectiveness of these EPR systems seems to exist: for similar levels of recycling rates there is a large variety of fees paid to the system.

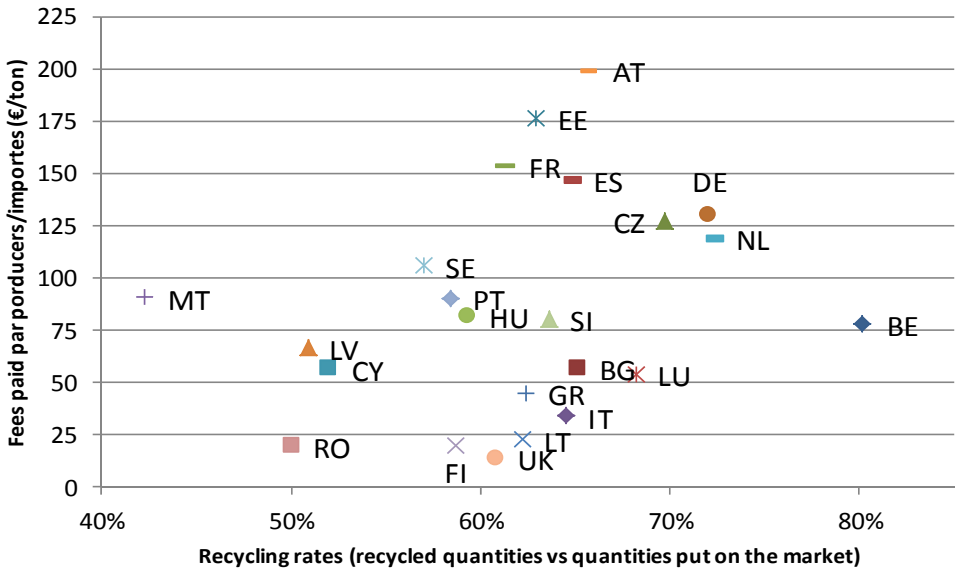


Figure 5: Cost effectiveness of EPR schemes – Packaging [36]

"Pay as you thrown" (PAYT) schemes, if properly applied, have demonstrated their effectiveness: in the areas where these schemes are in place, citizens are making efforts to reduce their waste production and at the same time the participation in separate collection dramatically increases. It has a direct impact on the amount of residual waste to be treated which is significantly reduced, leading to a reduction of the waste management costs for the local competent authorities. The vast majority of the regions meeting high recycling rates - more than 70% - are applying PAYT schemes. These schemes are not used widely enough by local authorities: it has been estimated that **only 3 MS have PAYT systems** in place in all municipalities although PAYT schemes are not present at all in 11 MS – most of them with poor performances in terms of waste management.

In the most advanced MS, , **local authorities are incentivised** to launch separate collection of waste: EPR schemes are well developed, landfill prices are high enough, there are sanctions in case of lack of initiative to favour recycling/reuse or prevention – notably the application of PAYT systems - and there is a financial support for the development of the required infrastructures: By contrast, some MS have put in place very efficient systems combining penalties and financial support for municipalities: this is the case for instance in

[35] Sources: fitness check and references 4 and 5 in Annex 2 (Part 3/3 of the document)
[36] Reference 5 in Annex 2 (Part 3/3 of the document)

the Walloon Region of Belgium where residual waste has dramatically decreased (minus 42%) within six years of the application of a system combing subsidies and charges for municipalities in relation with the amount of residual waste produced and the application of PAYT systems.[37] These incentives are generally missing in the less advanced MS.

Experience shows that some MS are making extremely rapid progress towards meeting the EU targets by an appropriate use of economic instruments: for instance, Slovenia already performs better than several EU 15 MS, rapid progress has been seen in the Czech Republic for packaging waste and Estonia is expected to move from a situation of 75% landfilling to less than 5% landfilling in less than 7 years thanks through a clever and ambitious use of economic instruments – See **Box 2**.

Box 2: From 75% to less than 5% landfilling in 7 years, the case of Estonia [38]

Estonia has decided to introduce a strong waste management policy aiming in the first instance at avoiding waste landfilling. A progressive increase in the landfill taxes has been sanctioned, making alternative options such as energy recovery, recycling and MBT financially more attractive: with tax increases, the price for landfilling went from 8€/ton in 2001 to 50 €/ton today and is expected to increase to 60-70€ per ton by 2015. Additional economic instruments such as EPR and deposit-refund schemes were also applied.

This has attracted private investors, and without any public financial support, major infrastructure has been put in place to treat all municipal waste produced in Estonia. The landfill rate was at 74% in 2006, around 68% in 2010 and is expected to drop to a few percentage points in 2013 with the entry into operation of two new MBT facilities and one Waste-to-Energy facility. In the medium term, the increase in the recycling rate might imply the necessity to … import waste generated outside Estonia and/or adapt the MBT plant so that separately collected waste could be treated to increase the overall recycling rates.

This success story demonstrates on the one hand that MS having recently joined the EU can, if they implement the best practices having demonstrated their effectiveness in the past in the most advanced MS, make very rapid progress. At the same time, the absence of midterm targets at EU level is detrimental to adequate planning and dimensioning of the needed infrastructures.

Use of structural funds

Lastly, as indicated in the recent report from the European investment Bank (EIB) and in the report of the Court of Auditors[39], **EU funds** whether originating from the EIB or from Regional funds have been so far mainly orientated **to the lower tiers of the waste hierarchy** – creation of landfills or incineration capacities. Existing funding procedures do not really fit with the type and the 'smaller' size investments needed for prevention, reuse and recycling.

Issues related to collection

The necessity to improve the **quality of the recycled material** is another issue highlighted during the stakeholder consultation and in the fitness check. According to the WFD, there is already a general obligation/principle for MS to ensure that 4 waste streams are separately collected (plastic, metals, paper and glass). This principle is not sufficiently strict to ensure an appropriate quality of the recycled materials: experience suggests that the best performing systems are those which keep certain materials separate from others. Glass should be collected separately to avoid contamination of the other waste streams. Similarly, paper and

[37] See: http://ec.europa.eu/environment/waste/framework/pdf/seminar_03_2013/8.%20Martine%20Gillet.pdf

[38] Source: http://ec.europa.eu/environment/waste/framework/pdf/seminar_03_2013/6.WM-Estonia_10MS-seminar_BRSL_Peeter_Eek_19-03-2013.pdf

[39] Source: reference 13 and 14 in Annex 1 (Part 3/3 of the document)

cardboard should also be collected separately to ensure the quality and the value of the material. However, mixed collection of plastics and metals is not detrimental to the quality of the materials. Separate collection of biowaste gives excellent results in terms of organic recycling and that the highest rates of recycling appear to be achieved through door-to-door collections, where these are practical, and by deposit refund schemes for instance for beverage containers.[40] The **absence of coordination** between the authorities in charge of waste collection and those in charge of waste treatment is another reason for inappropriate design of the waste management strategy leading to poor quality recycling and increased costs. As detailed below (section 5.2.1 and Figure 10), collection and treatment costs are linked. It is therefore essential to ensure a full consistency between the collection and treatment strategies.

Similarly higher recycling rates of better quality seems to be met for **C/D waste** when **minimum sorting** is ensured at source at least between the mineral fraction and the other dry fractions. Some MS have imposed minimum sorting requirements for C/D waste.

Social acceptance

As illustrated in a recent report from European investment Bank[41], the lack of appropriate infrastructure might also be linked in some cases to the **absence of social acceptance** of projects related to waste management. In some countries where there is a significant lack of infrastructure it has been virtually impossible to designate areas for the construction of waste management facilities – See Box 3 below. Experience shows that public opposition seems to be higher against incineration or landfilling projects then for other facilities such as sorting centre for recycling/reuse or composting plants based on source separated waste streams.

Box 3: Social acceptance – some concrete examples

In several places, local people have sometimes vigorously campaigned against the creation of incinerators or landfills. For instance, in Corfu Island it has not yet been possible to open a newly-built landfill - the Lefkimi landfill – due to violent protests in 2008. This infrastructure was built with the support of EU funds – a total of €6 million. In the region of Athens and Thessaloniki, but also around Naples in Italy, similar protests took place against the possible opening or extension of landfill sites. In the UK, several projected waste infrastructure – mainly incinerators - were abandoned due to local opposition including the King's Lynn incinerator as well as infrastructure in Bradford, Merseyside and Yorkshire. These are just examples of some of the most recent local opposition against major landfill and incinerator projects.

2.5.2. Issues related to the EU waste legislation

As pointed out during the stakeholder consultation but also by the Court of Auditors, the exiting waste legislation could be further simplified and clarified while providing a midterm vision. For instance, the legislation includes the obligation for the MS to respect the waste hierarchy. However, the **absence of clear and smart targets** for each step of the waste hierarchy as well as clear **midterm perspectives** represents a significant barrier and a clear problem for appropriate planning of the required investments. In many cases, the time which elapses between the decision to build new waste management infrastructure and its actual operation is around 7 years[42], the period being longer or shorter depending on the nature, and the acceptability of the infrastructure at local level. Some of the infrastructure which is built may have a useful of time of 20 years or more. This absence of clear targets at each step of the hierarchy prevents MS from conveying a clear vision on an optimal implementation of the hierarchy.

[40] Reference 1 in Annex 1 (Part 3/3 of the document)
[41] Reference 15 in Annex 1(Part 3/3 of the document)
[42] Source : reference 1 in Annex 2 (Part 3/3 of the document)

It has also led in some MS's to the **creation of overcapacities** for instance of incineration, which, in turn, appears to have lowered the fees paid for incineration, and so reduced incentives for additional initiatives to be taken to promote prevention, re-use and recycling. As shown in Figure 6, four MS have an incineration capacity exceeding 50% of their annual municipal waste generation, two of them – DK and SE – are even not producing enough municipal waste to feed existing infrastructures. This situation may be alleviated if the excess capacity is covered by waste imports from other MS and/or by feeding the existing capacities with other categories of waste such as industrial non-hazardous or commercial waste. Figure 6 shows clearly that some MS having excess capacities could progressively accept more and more waste coming from countries still heavily relying on landfilling.

Nevertheless, there are clear signals of potential overcapacities which are even more significant at local level. This is for instance the case in Rotterdam where an incineration plant was recently closed due to its underutilisation – see **Box 3**. Recent information from Germany indicates an overcapacity of incineration of around 25%. By contrast, as shown in Figure 6, some MS currently landfilling significant amounts of municipal waste have no incineration capacities at all.

Box 3: Closure of the Rotterdam incineration plant

The private company owning an energy-from-waste plant in Rotterdam decided to close it in 2010 due to the extent of overcapacity - around 10% according to the NL public authorities - caused by a declining availability of waste. This incinerator modernized in 1996 had a capacity of 450.000 tonnes. In 2012, the company stated, "*We closed one of our incineration plants in the Rotterdam area. There is overcapacity in Germany and we hope some of our colleagues will follow suit. We hope more capacity will be taken out of the market. In the end, we could harm recycling performance. The social importance of incineration will decrease whilst recycling becomes increasingly relevant and important*."

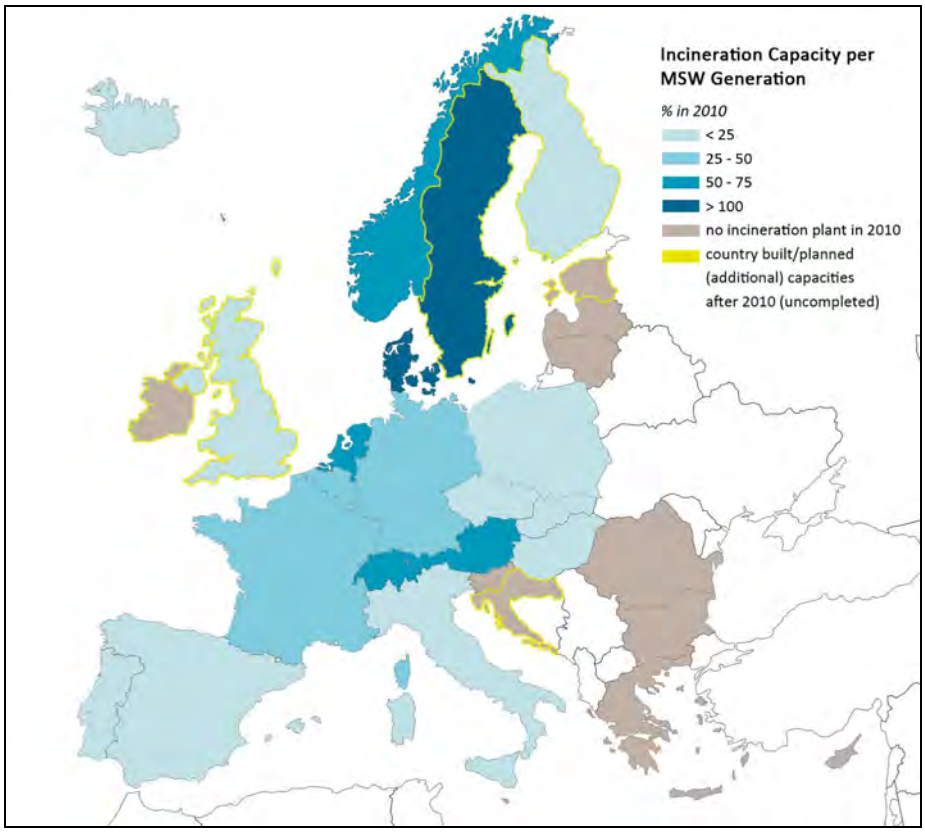


Figure 6: Municipal waste incineration capacity per municipal solid waste generation[43]

The absence of EU midterm targets combined with longer term MS strategies could also lead to **sub optimal investments:** for instance several mechanical biological treatment - MBT-facilities treating mixed waste were created without source separation of waste. Some of these facilities are leading to modest recycling rates, most of the output products being landfilled due to their poor quality (contaminated materials).

Recent assessments carried out on the existing waste management plans[44] clearly shows that in some poor performing MS, investments currently planned will lead to the creation of several MBT or incineration facilities which will allow those MS to just meet the existing EU targets (on landfill diversion) but 'blocking' these MS into technological choices for, in some cases, 20 years (lifetime for these facilities).

This would limit the perspective of progress for these MS while leading to relatively high levels of residual waste landfilling. Recycling and re-use rates will remain modest in these countries for a long period unless one or more of the following occur:

1. capacity at these facilities can be sold to other countries still short of capacity – this is only possible, in principle, for facilities designated as recovery; or
2. facilities, such as some MBT facilities, are adapted so that the biological treatment part of the facility is used for dealing with source separated organic materials; or
3. some of the facilities are closed before the end of their amortization (and this may represent an additional cost).

[43] Reference 14 in Annex 2 (Part 3/3 of the document)
[44] References 6 and 14 in Annex 2 (Part 3/3 of the document)

As detailed in **Error! Reference source not found.**, some **definitions** are either unclear or not consistent between the concerned Directives - for instance the notion of 'recycling' differs from the Packaging waste Directive (PPWD) to the WFD The **concept of 'municipal' waste** remains too vague and leads to divergent MS interpretations and hence widely differing levels of re-use/recycling. Significant differences exist between MS in terms of municipal waste generated per capita (between 300 and 700 kg/inhab/year).[45] Part of these differences could be explained by economic characteristics - individual consumption levels - but it seems that MS are reporting different realities under the name 'municipal waste'.

The share of household waste in the municipal waste varies from a MS to another mainly due to difficulties experienced by MS in separating 'household waste' from non-household waste collected in the same way. Additional effort is needed to improve reporting on 'municipal waste' in order to get a sound basis for comparing MS performance and ensure that the targets on municipal waste are established on solid basis.

Calculation methods are too complex and not sufficiently harmonised to allow a proper comparison of MS performance. For instance, 4 calculation methods are permitted for assessing the municipal waste recycling target - see Box 1. MS had to report by September 2013 on the recycling/reuse rates according to the method they have chosen for the calculation of the target. A comparison between the reported recycling rates by the MS according to the method they have chosen and the recycling rates for municipal waste as reported annually to Eurostat since the mid-nineties – equal to calculation method 4 and based on OECD/Eurostat guidelines - shows that depending on the method chosen, the results could vary significantly: methods 2 and 3 are less demanding than method 4 - see Table 3.

The reported level of achievement under the WFD target can be more than 3 times what is reported to Eurostat. This is also confirmed when considering recycling performance based on typical waste composition – recycling rates of 50% could be met with method 2 although the actual recycling rate for municipal rate amounts to 25% - by using method 4.

This means in practice that the existing flexibility related to the calculation method is leading to confusion about the actual performances of the MS and their capability to re-inject recycled materials in the EU economy.

This comes on top of problems related to the quality of statistics – for instance ES, LV and Sl are using the method 4 but contrary to FI, they do not have the same recycling rates than those reported by Eurostat.

[45] Reference 1 in Annex 2 (Part 3/3 of the document)

MS having reported (Jan 2014)	Method chosen by MS	Reported Re-use/recycling rate [1]	Recycling rate - Eurostat [2]	Ratio [1]/[2]
AT	2	Not reported	62%	
BG[46]	3	31%	6%	5.2
CY	2	22,4%	20%	1.1
CZ	2	49,60%	17%	2.9
DE	4	Not reported	62%	
DK		Not reported	43%	
ES	4	27%	33%	0.8
FI	4	35%	35%	1
GR	2	Not reported	18%	
HU	2	39,80%	22%	1.8
IT	2	38,50%	33%	1.2
LT	2	43%	21%	2.0
LU	3	49,80%	47%	1.1
LV	4	17,8%	11%	1.7
MT	1	23%	7%	3.3
PL	2	18% (2012)	28%	0.6
PT	2	Not reported	20%	
SE	2	62%	50%	1.2
SI	4	34,20%	40%	0.9
SK	2	13,38%	11%	1.2
UK	3	43%	39%	1.1

Table 3: Reported recycling/reuse rates by MS and Eurostat recycling rates

The **landfill diversion target** - based on biodegradable waste produced in 1995 - opens the door to interpretation from the MS on what should be considered as biodegradable waste and on what was the 1995 level of landfilling of this type of waste. This increases the uncertainties around this target. Similarly the absence of a practical definition of the notion of 'treatment' makes it difficult to verify whether waste is actually treated before being landfilled.

The **measurement method for C/D** – construction and demolition – waste also raises questions. The WFD imposes a 70% target of 'material recovery' which includes recycling but also 'backfilling'[47] which is extremely difficult to monitor in practice. **Error! Reference source not found.** in **Error! Reference source not found.** and Table 4 below illustrate the differences between the material recovery rates as reported by MS, the rates calculated by Eurostat and the relative importance of backfilling.

Backfilling represents an important share of the reported data in some MS: on the basis of the Eurostat data, 12 MS reported backfilling rate between 0% and less than 0,5%, 6 MS reported backfilling rates between 1,15 and 20% - 5 MS reported backfilling rates higher than 20%.

Member	Material recovery rate	of which backfilling

[46] BG is in process of revising its reporting to Eurostat

[47] 'Backfilling' is defined as 'a recovery operation where suitable waste is used for reclamation purposes in excavated areas or for engineering purposes in landscaping and where the waste is a substitute for non-waste materials'

State	Reported by MS	Eurostat	Reported by MS	Eurostat
AT		91,8%		0%
BE		73,6%		0%
BG	21%	61,6%		0%
CY		0,32%		0,32%
CZ	86,4%	91,1%	30,8%	35,33%
DK		82,5%		0%
DE		95,3%		9,4%
EE		96,4%		9,3%
ES		64,8%		23,7%
FI	33%	5,5%		0%
FR		66%		7,6%
GR		0%		0%
HU	60,2%	60,7%		7,5%
IE		96,9%		30,14%
IT		96,9%		1,1%
LT	65%	73,2%		0%
LU	90,8%	98%		?
LV		90,8%		?
MT		14,2%		0,07%
NL		99,2%		0%
PL	69%	92,6%		22,5%
PT		48%		?
RO		37%		0%
SE	60%	77,6%		0%
SI	78,7%	94%		1,17%
SK	45,4%	46,7%		?
UK	92,7%	97,8%		22,1%

Table 4: Comparison between reported material recovery rates and Eurostat data

The **articulation of the target** still causes problems: for instance and as highlighted in the fitness check, there is no clear relationship between the landfill diversion target for municipal biodegradable waste, the recycling target for municipal waste and the recycling target for packaging waste which also partly covers municipal waste. As also highlighted in the fitness check, the existing legislation still includes some **obsolete requirements** which could be removed. For instance, this is the case in the PPWD in which a 'maximum' target was fixed for recycling in contradiction with the evolution of the recycling markets.

Moreover, even though significant efforts have been made to streamline and simplify **reporting obligations,** there is still room to improve and further streamline these obligations. MS are required for each Directive to produce a tri annual report to the Commission which in turn is required to produce reports on the implementation of the Directives. In practice, these reports which are mainly qualitative have a very limited added value compared to the administrative burden they involve. **Error! Reference source not found.** in **Error! Reference source not found.** summarises the demanding flow of MS reporting obligations – more details being provided in **Error! Reference source not found.**.

Similarly, according to the WFD a permit is necessary for all undertakings managing waste (Article 23). During the stakeholder consultation, it was pointed out that in some MS, **SMEs producing or managing small quantities** of non-hazardous waste have to comply with this procedure which leads to additional administrative burden for a very limited added value.

The problem of **littering**, while covered by the general provisions on waste prevention and management (e.g. articles 9-13 and 36 of the WFD), is not explicitly addressed in EU waste legislation. It is only in the recent Commission proposal (COM (2013) 761) amending the PPWD to reduce the consumption of lightweight plastic carrier bags that the issue is referred to in its own right.

2.5.3. Issues related to monitoring

As repeatedly mentioned by stakeholders, pointed out by the Court of Auditors, and highlighted in the fitness check, another difficulty is related to the **quality of waste statistics**. Significant efforts have been made at European level with the creation of the Eurostat waste data centre. Nevertheless, as illustrated in Table 3 and in Table 4, additional efforts to improve statistics particularly on C/D waste are needed: differences persist between what is reported under the WFD and otherwise to Eurostat. No clear binding procedure is in place to ensure a minimum data validation either at European level - the current approach is only indicative - or at MS level. Only few MS have set an internal validation procedure.

This might lead to **divergent data flows** - there are some examples of MS in which the Ministry of Environment is reporting different data from the official statistical office – with differences up to 30% in the case of municipal waste generation.[48] Additional layers of uncertainty are related to the fact that some MS do not follow the guidance provided: for instance, and as shown in the fitness check, under the PPWD, MS are allowed to report as 'recycling' the material which is separately collected. Difficulties also emerged from the absence of common interpretation on what is or is not packaging.

However, losses between what is collected and what is effectively recycled may be significant: for example, the Court of Auditors report has indicated, loss rates of between 26% and 50% at the five facilities which were examined. In some cases, the implications of such loss rates would be that if recycling was reported on the basis of what was collected, this would amount to an over-estimate of the recycling rate of between 33% and 100%. This could encourage MS to maintain poorly designed waste collection systems and management not sufficiently focused on quality and efficiency.

The **absence of anticipation** of the risks of non-attainment of the targets by the MS is another significant problem. The current approach to checking whether targets are met is based on statistics reported a posteriori by MS. In most of the cases, when the assessment is completed and possibly infringement procedures launched, it is too late to **take appropriate and timely correcting measures** due to the time needed for instance to launch additional programs of separate collection and to build the required infrastructure.

Between the non-attainment of one of the targets of the EU legislation and the launching of an infringement procedure a period of three years is usually needed, in particular to acquire and check the relevant statistics.

2.5.4. Gap between EU objectives and existing targets

The level of the existing targets remains too low to ensure the creation of a circular economy using waste as resource and to meet the concrete objectives provided by the 7th EAP and recently endorsed by the European Council and the Parliament, the Raw Material initiative and the Resource Efficiency Roadmap as well as through one of the key Europe 2020 objectives to build a more 'resource efficient' economy.

[48] Reference 6 in Annex 2 (Part 3/3 of the document)

Meeting the existing landfill diversion target for biodegradable municipal waste will **still allow landfilling significant amount of valuable waste** as this target is based on 1995 data, covers only the biodegradable waste (and not all waste) and allow for landfilling in 2020 of 35% of the amount of biodegradable waste that was generated in 1995. Meeting the existing target for packaging waste (55% recycling) will leave 45% of packaging waste not re-used or recycled although the potential remains significant as illustrated by the current performances of the most advanced MS (around 75% recycling in 2010). The four methods for meeting the 50% recycling/re-use rate for municipal waste in practice leads to not reuse/recycle between 25 and 50% of municipal waste as illustrated in section 2.5.2.

In addition and as detailed in the following section, without additional EU initiative to raise the existing targets, a significant amount of waste will still be lost to the EU economy whilst no clear medium-term signal will be given to waste management operators.

The targets should be revisited in the light of the multiple potential benefits linked with improved waste management - job creation, new economic activities, innovation in a promising sector, reduced GHG emissions, contributions to renewable energy generation, improved amenity - and the increasing challenge of raw material access for EU industry.

The current performances of the most advanced MS clearly show that a significant degree of progress is possible for all MS in the midterm. As shown in the fitness check, most MS have already met and surpassed the targets of the PPWD. The fitness check also highlighted the fact that the PPWD has had a significant impact in promoting the establishment of selective collection not only for packaging but also for other waste streams.49

Some MS are already today recycling more than 50% of their municipal waste – with some peaks at regional level of 70 to 85% - while 6 MS are landfilling less than 3% of their municipal waste - see Figure 3 and Figure 9. The vast majority of stakeholders have also shown an ‘appetite’ for increasing the recycling targets and building on progress already made to move closer to the vision of a resource efficient economy.

2.6. How will the problem evolve?

Without further policy action, significant amounts of valuable resources will continue to be lost in the coming years. Without a clear midterm perspective on the vision for waste management, there is a risk of investing in inflexible large-scale projects such as incineration and/or MBT facilities which may hinder longer-term ambitions to improve resource efficiency. The dissemination of best practices will remain limited, the quality of essential monitoring tools such as statistics on waste generation and management will remain sub-optimal and reporting obligations will remain complex and with limited added value.

In order to assess the impact of the existing measures for municipal waste, a **‘Business as usual scenario’** has been developed. This scenario presents an objective view of likely future waste management based upon realistic expectations for the performance and delivery of future waste management systems. A variant of this scenario has been constructed presenting the intentions of MS - understandably, in most cases the stated intention is that MS plan to achieve the targets, thus this variant is close to the full implementation scenario.

The functioning of the model is summarised in Figure 3.1 - Annex 6 which includes a summary of the key assumptions and data sources which have been used to calculate the financial and environmental impacts of the policy options considered in this IA.

As shown in Figure 7 below, the business as usual scenario implies a modification of waste collection and treatment: more waste will be recycled and reused, energy recovery will slightly increase and landfilling will decrease by nearly 40.000 tons.

[49] Source: reference 25, Annex 2 (part 3/3 of the document)

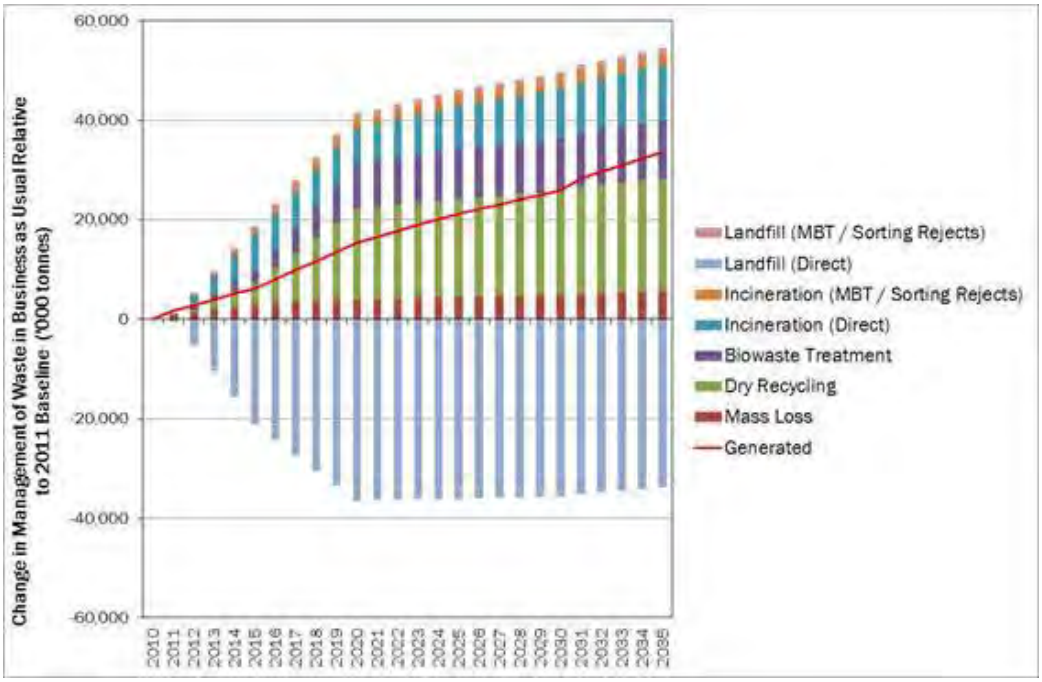


Figure 7: Changes in waste treatment - Business as usual scenario

Despite these expected changes in waste management, there is a risk that some MS will fail to meet the existing targets on time: without additional actions, 9 MS will have difficulties in achieving the existing recycling target for municipal waste – see **Error! Reference source not found.** in **Error! Reference source not found.**. 5 MS are not making enough progress towards the landfill diversion target (see **Error! Reference source not found.**). According to the marine litter reduction model, it is estimated that a 4.4% increase of inflow of new marine litter by 2020 can be associated with this scenario.

2.7. Who is affected and how?

Several stakeholders are affected by the loss of valuable materials and improper waste management:

As explained in section 2.2, **the manufacturing industry** might be confronted with additional increases in raw material prices in the midterm. This risk might be attenuated by improving waste management as a significant proportion of raw materials needed for the manufacturing industry could be re-injected back into the economy at a reasonable price level. At the same time, the manufacturing industry placing goods on the market is confronted with different systems of EPR in the MS. These differences might represent an obstacle to the functioning of the internal market. In addition, as shown in Figure 5, several EPR schemes are not cost effective which might be due to the lack of transparency combined with the absence of minimum conditions (control, fair competition etc.). Several MS are envisaging now additional EPR schemes and without ensuring that they are meeting minimum conditions there is a risk of creating ineffective additional systems.

Waste operators whether **large companies or SME** involved in waste collection and treatment might be affected by the absence of new initiatives to ensure proper implementation of the EU waste legislation and by the lack of mid-term clear and measurable targets. As highlighted during the stakeholder consultation, improper waste management could represent a barrier for the development of new business in the collection, sorting or treatment sectors. Without a clear midterm vision on waste management, there is a risk of sub optimal investments in the sector – see **Box 3** as an example.

The recycling industry has already benefited from the European targets in the past. It has been demonstrated that without clear European targets it would have been impossible to develop sustainable recycling activities. Without further efforts to simplify the EU legislation, **SME's** might be confronted to administrative burden – particularly when SME's are handling small quantities of waste.

EU citizens are first in line to improve waste management as one of the key players in the chain having to participate in separate collections schemes. Nevertheless, they do not always benefit from optimal organisation of waste collection. This has consequences in terms of general taxes to be paid which might increase due to improper waste management – for instance due to inappropriate investments, creation of overcapacities, lack of coordination between collection and treatment or investments being made too late which might ultimately lead to infringement proceedings and even fines. Also, EU citizens often pay general taxes for waste management without links to efforts to prevent and separate waste.

As consumers, they pay a contribution to EPR systems without having a clear choice and in absence of appropriate level of information on how the funds collected are used.

At local level, landfills cause multiple nuisances including noise, dust, poor air quality and negative impacts on landscape. Improper management of landfills, particularly those located near water bodies, can lead to pollution of the rivers and sea. This in turn can lead to contamination of the food chain, for instance when plastic particles ending up in the marine environment is ingested by fish, which has potential adverse impacts on public health.

Public authorities are also key players in waste management: at local level - municipalities, associations of municipalities - they organise the collection and the treatment of waste for household and similar sources whether through their own operating means or through services provided by private operators. Local authorities are also directly concerned by littering which represent additional and frequently significant costs of cleaning of the streets, beaches, forests. Without new initiatives for instance to promote best practices, there is a risk that inefficient systems persist with different effects notably on the public budgets devoted to waste management.

Others - tourism and fisheries: in some parts of the Union, improper waste management, and in particular illegal landfilling and littering, have a direct impact on the development of tourism. Beach littering has a particularly detrimental impact, with clean-up costs estimated at €413,5 million per annum – see Annex 7.

The fisheries industry is also negatively affected from marine litter causing damage to propellers and fishing gear. Costs associated with this damage are estimated to be €57.2m, equivalent to approximately 1% of the total revenues from catches that are generated by the EU fleet (landed value from 2010).

2.8. The EU's right to act and justification

The proposal is a direct response to the Europe 2020 Strategy, in particular its flagship initiative on "A Resource Efficient Europe", and is closely related to the EU's Resource Efficiency Roadmap and its Raw Materials Initiative.

The Union competence to take action on waste management derives from Article 191 of the Treaty on the Functioning of the European Union related to the protection of the environment: "Union policy on the environment shall contribute, among other things, to protecting and improving the quality of the environment, protecting human health, ensuring prudent and rational utilisation of natural resources, and combating climate change".

In the WFD, the Landfill Directives and the PPWD, the legislator has included review clauses for the targets, calling on the Commission to envisage their reinforcement - see Box 1. Experience from the past has shown that European objectives and targets for waste management have been a key driver for better resource and waste management in the vast majority of the MS. Common objectives and targets also help improve the functioning of the EU waste market e.g. by providing guidance to investment decisions and ensuring cooperation between MS. EU wide targets are also needed to create the minimum scale for the EU industry to invest in new recycling techniques.

Transnational aspects of the initiative are also related to environmental aspects: inappropriate waste management leads to additional GHG and air pollutant emissions whether directly emitted by landfills or indirectly through extraction and processing of virgin raw materials which could have been avoided through increased reuse and recycling.

Taking measures to reduce landfilling will have impacts related to EU wide aspects such as GHG emissions, transboundary air pollutant emissions and losses of valuable resources. Reducing landfilling has therefore the potential to contribute to European policies in terms on GHG and air emission reduction on top of resource efficiency policies. A European wide approach is also necessary to avoid that some MS by continuing to base their waste management strategies on 'cheap' landfilling creates the conditions to 'import' potentially massive amounts waste preventing the creation of an EU wide recycling industry. These real risks of increased shipments of waste for disposal to MS where landfilling continues to be allowed for longer can be limited by fixing similar deadlines at European level to progressively remove recoverable waste from landfills.

Littering, especially in the marine environment, is also a problem with transnational implications. Material which escapes the waste management system is frequently transported from one MS to another via inland waterways, and once it reaches the sea, it does not respect maritime boundaries. Plastic litter in particular is problematic, given its long lifetime, and its tendency to disintegrate into ever-smaller pieces, which frequently enter the food chain when ingested by marine life. Without setting coherent targets at European level, there is a risk that the efforts achieved by some MS could be undermined by a lack of similar efforts in neighbouring MS. A headline reduction target for marine litter at EU level will support Member States in the establishment of (sub-)regional marine litter reduction targets and in achieving the national targets which they are obliged to adopt under the Marine Strategy Framework Directive.[50]

3. OBJECTIVES

The **main general objective** of the review is to ensure that valuable material embedded in waste is effectively re-used, recycled and re-injected into the European economy – in other words, to make progress towards the **creation of a circular economy** where waste is progressively used as resource.

[50] Marine Strategy Framework Directive 2008/56/EC

Moving towards a circular economy will ensure that that opportunities linked with proper waste management will be seized by the European Union – notably in terms of job creation, GHG emission reduction, reduction of marine litter, improving the EU security of supply of raw materials and contributing to the development of a EU recycling industry.

The **specific objectives** of the review could be summarised as follows:

1. **Ensuring improved waste management in all MS** by ensuring the dissemination of best practices and key instruments already applied in the most advanced MS and notably by promoting and if necessary imposing the use of key instruments including economic instruments particularly in those MS considered as 'at risk' of non-attainment of the targets, ensuring a minimum level of harmonization of the EPR schemes at EU level to ensure their optimization and orientating the forthcoming investments in the field of waste management as a priority towards the first steps of the waste hierarchy.

2.. **Simplifying the European legislation** by clarifying and simplifying measurements methods related to targets, by adapting and clarifying key definitions, ensuring the consistency of the targets through an integrated approach and removing obsolete requirements from the legislation and by dramatically simplify reporting obligations.

3. **Improving monitoring** of the legislation and the legally binding targets by improving the quality of waste statistics, particularly where targets are concerned, by anticipating possible problems of implementation with the development of an "early warning" procedure.

4. Ensuring that the European mid-term targets are aligned with **EU aspiration** in terms of **resource efficiency** and **raw material access** by clarifying the waste hierarchy and fixing new midterm targets aiming at giving a clear early signal to the MS and the industry on the vision of the EU. Opportunities linked with improved waste management have to be seized – modern waste management can contribute to innovation, competitiveness, job and economic activity.

The links between the proposed objectives, the problem definition and the causes of the problem are summarised in the first part of Table 5 below.

In the midterm and in line with the ambition of the 7th EAP recently endorsed by the Council and the Parliament in Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 'Living well, within the limits of our planet'[51], the following **operational objectives** have guided the review:

- waste generation decline and is decoupled from GDP evolution;
- reuse and recycling are at the highest level feasible – 70% for municipal waste at the horizon 2030;
- incineration is limited to waste which is not recyclable;
- landfilling is limited to 'residual' waste – around 5% of waste generated;
- achievement of significant reductions in marine litter, in order to prevent harm to the coastal and marine environment;

[51] OJ L 354, 28.12.3012, p. 171

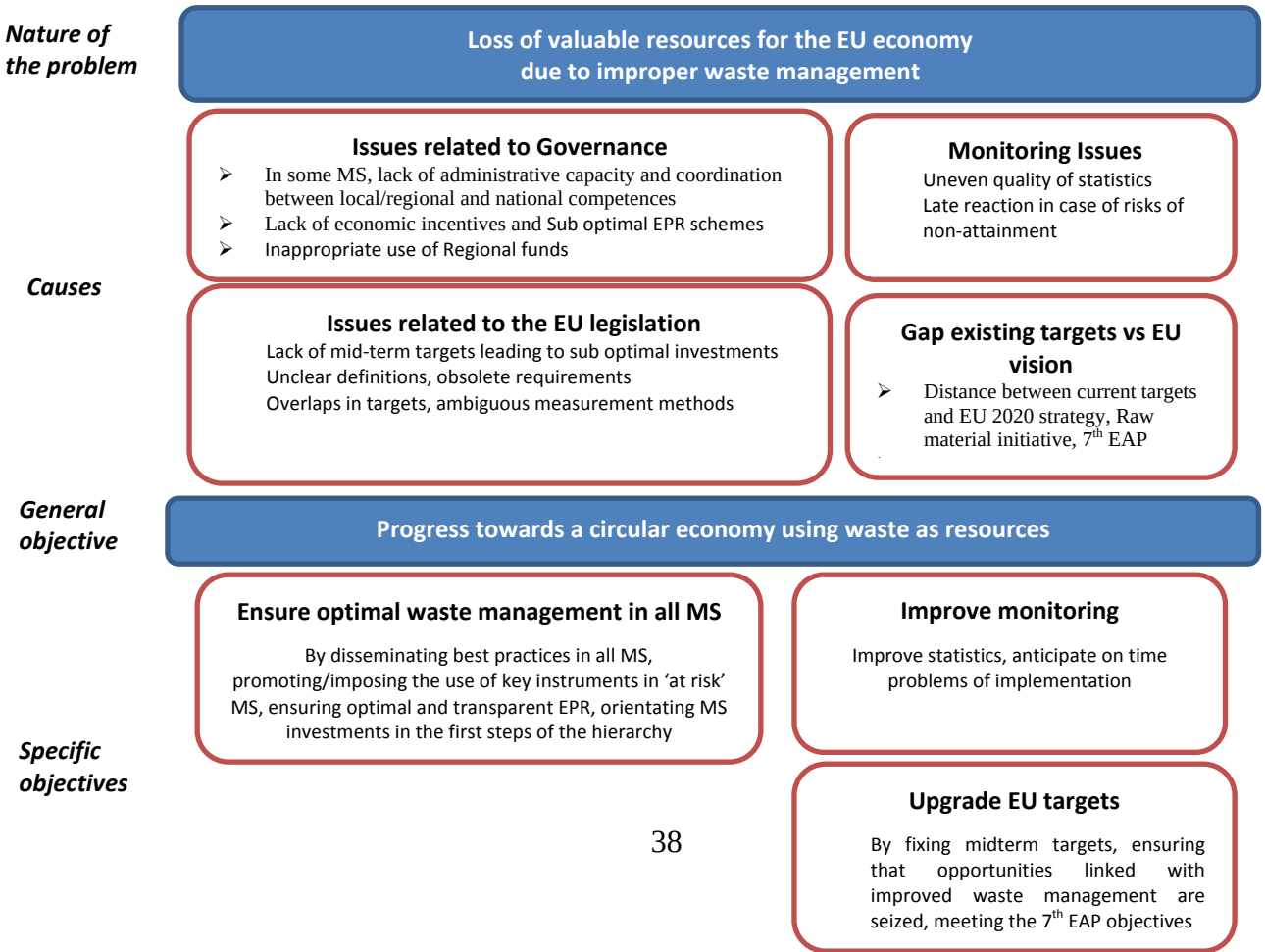
- best practices are in place progressively in all MS;
- a proper and reliable monitoring strategy is in place at EU and MS levels.

These objectives are in line with the **Europe 2020** strategy and particularly with the objective of promoting **sustainable growth** based on a 'resource efficient' economy – one of the 7 flagships of the strategy.

They also have the potential to contribute to several targets of the EU 2020 strategy including the creation of new skills and jobs especially in the less favoured areas of the Union where waste management is often not yet optimised, the promotion of innovation through research and the development of new technologies for instance to improve waste sorting and recycling operations but also to improve the eco design of products and the reduction of energy demand and related GHG emissions at a promising opportunity cost compared to other sectors by using more recycled materials compared to virgin materials.

Some contribution to poverty reduction might also be expected by the creation of non-qualified jobs which are, for the most part, impossible to outsource as well as by the development of re-use activities placing goods on the market for a second or subsequent time, at a reasonable access price.

The objectives to simplify legislation and reduce regulatory burdens (including for SMEs) as well as to ensure that targets are 'fit for purpose' are in line with the Commission's efforts to ensure regulatory fitness.



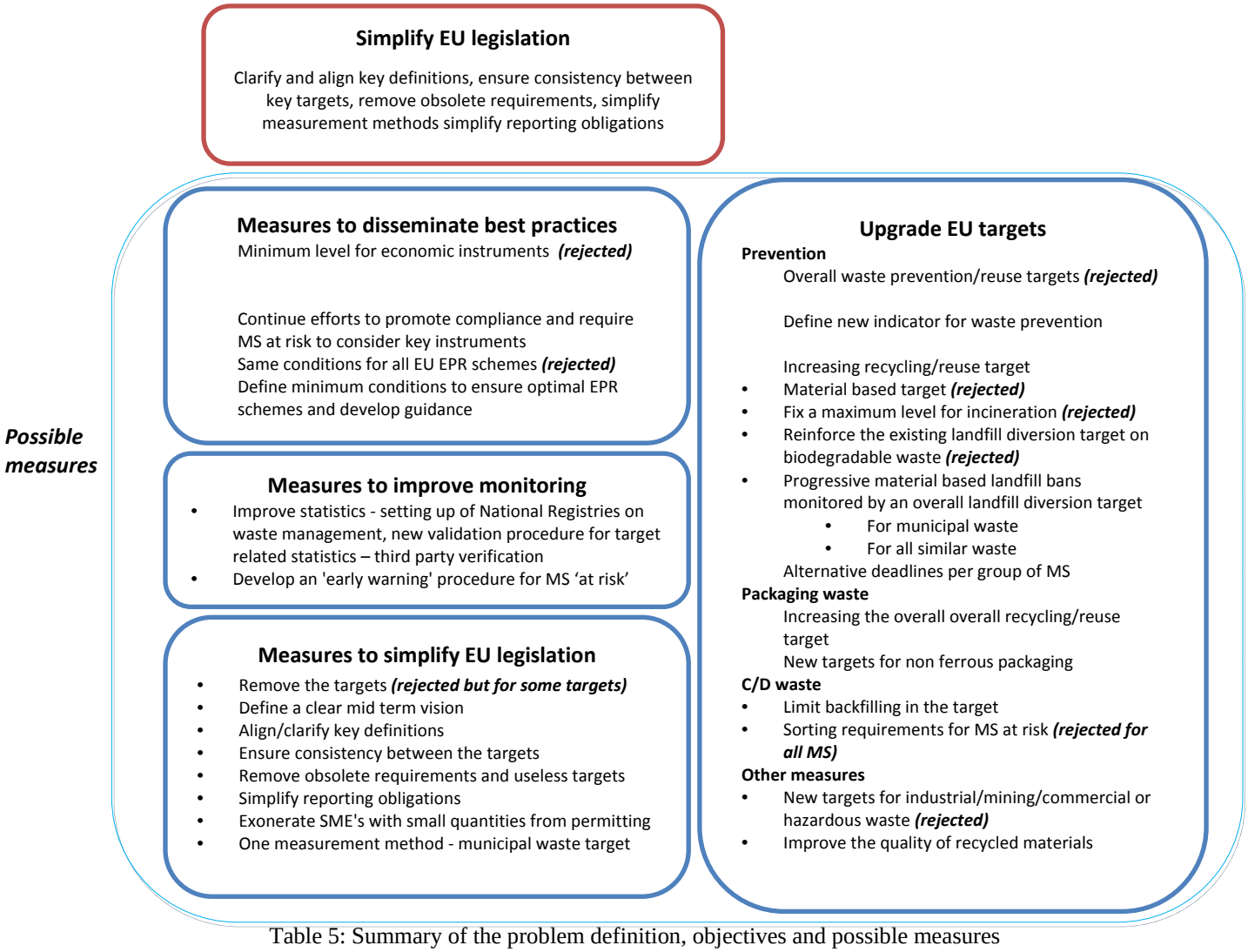
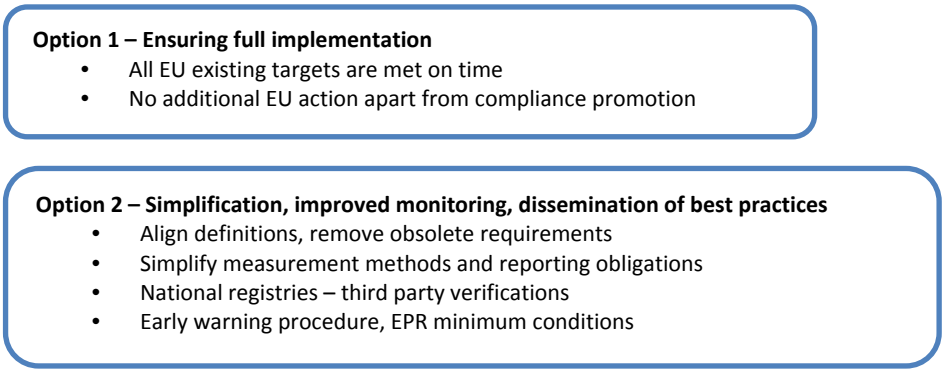


Table 5: Summary of the problem definition, objectives and possible measures

4. POLICY OPTIONS

A large scoping exercise was undertaken during which a long list of possible measures for change were considered. In the context of this IA, the most relevant and/or most preferred measures are analysed. Further details on the main reason for rejection of some of the Options considered during the consultation are given in Annex 6.

The links between the proposed measures, the objectives and the problem definition is summarised in Table 5 above which also takes into account the main conclusions from the fitness check The proposed measures detailed in Table 5 above have been re-grouped into 3 main options (Option 1: ensuring full implementation, Option 2: simplification, better monitoring and best practice dissemination and Option 3: Upgrade the targets). A summary of the proposed options for analysis is given in the following Figure which makes the link with Table 5 above. The content of each Option is discussed in the following Section.



Option 3 – Upgrade EU targets

- Option 3.1 – Increase the recycling/reuse target for municipal waste
  - Low: 60% reuse/recycling target by 2030; 50% by 2025 with only one method
  - High: 70% reuse/recycling target by 2030; 60% by 2025 with one method
- Option 3.2 – Increase the packaging waste targets
  - Basis: top MS results in 2010 combined with stakeholder signals
  - Variant: target for nonferrous metals
- Option 3.3 – Limiting landfilling to residual waste
  - Ban on plastic/paper/glass/metals by 2025 (max 25% landfilling), global ban by 2030 (max 5%)
- Option 3.4 – Combination of options 4.1, 4.2 and 4.3
- Option 3.5 – same as option 3.4 with different deadlines for different groups of countries
- Option 3.6 - same as option 3.4 with more stringent deadline for all MS with the possibility of time derogation for some MS
- Option 3.7 – same as option 3.4 with landfill ban on all similar waste

Figure 8: Summary of the options considered

A 'No policy change' Option assuming that no policy change is introduced in the existing legislation and that no additional actions are taken to ensure a proper implementation of the existing targets has not been considered for further analysis. As detailed in section 2.4, there is a risk of non-attainment of the targets by some MS. This scenario - corresponding to the 'Business as usual' scenario - will not allow meeting most of the objectives defined in section 3 and therefore was not considered as an Option as such but simply as a 'scenario' useful to assess the possible impacts of ensuring the full implementation of the EU legislation.

4.1. Option 1: Ensuring full implementation of the existing legislation

This option assumes that all MS will meet all the existing targets on time. It will require additional efforts in some MS even though some MS have already met ten years in advance (2010) all existing targets. No additional EU legislative action is considered under this option.

Nevertheless, ensuring the full implementation of the targets will not be possible without disseminating some best practices – such as a minimum use of key economic instruments. In that sense, the Commission will have to continue its efforts to promote compliance on a voluntary basis notably by ensuring a follow-up of the already launched initiatives such as the establishment of Roadmaps for MS at risk and additional follow-up initiative.[52] This option corresponds to the 'full implementation' scenario in the model on municipal waste.

4.2. Option 2: Simplification, improved monitoring and dissemination of best practices

This option includes a combination of legislative and non-legislative measures to simplify the existing legislation, improve its monitoring and ensure the dissemination of best practices. These measures do not include any changes in the targets themselves apart from simplifying the measurement methods. They imply some changes in the legislation and will contribute to ensure a proper implementation of the existing and future possible targets. In that sense, this option might be considered as complementary to Options 1 and 3.

Measures to simplify the EU waste legislation

[52] See reference 6 in **Error! Reference source not found.** as well as a summary of the actions taken at Commission level to promote compliance: http://ec.europa.eu/environment/waste/framework/support_implementation.htm

Several **problems of definitions** have been identified and highlighted during the stakeholder consultation. There is a consensus to align the definitions of 'recycling' and 'reuse' between the PPWD to the WFD which is one of the main recommendations of the fitness check. In practice, it is proposed to align the definitions included in the PPWD to those of the WFD. A better definition of 'municipal waste' in the WFD and in the Landfill Directive is needed to avoid major differences of interpretation between MS. The definition of municipal waste should be as far as possible aligned with the one used at international level (OECD) and by Eurostat. In practice, it is proposed to include a definition of 'municipal waste' in the WFD. The added value of launching a complex discussion on the definitions of 'biodegradable' waste and 'treatment' in the Landfill Directive might be limited at this stage if this target is not extended beyond 2020 (see section 4.2), therefore no specific action to clarify these concepts is proposed.

Establishing a **single measurement method** for the target for household and other similar waste is a proposal supported by the stakeholders. It is proposed to allow only one measurement method – that is, Method 4 - which is based on the total amount of municipal waste recycled. The other methods were rejected due to their complexity and lack of correspondence with the internationally recognised definition of municipal waste.[53] As detailed in section 4.4 (see Table 6), knowing that changing the measurement method has implications on the level of the target and for legal certainty reasons, it is proposed to move towards only one measurement method by 2025 at the latest. This will give enough time to MS to adapt their waste management plans (see section 4.4).

Similarly, for **C/D waste** further action should be taken to avoid abuse from some MS when they report on backfilling which represents a significant and hard to monitor amount in some MS **–** see Table 4**.** High levels of backfilling prevent MS from making enough efforts on recycling C/D waste. It is therefore proposed to further analyse the possibility of fixing a maximum ceiling for backfilling in the context of the calculation of the recovery target. In practice, this should be achieved in the coming months on the basis of additional studies aiming at gathering enough evidence on the potential impacts of fixing such a ceiling.

A **drastic simplification of the reporting obligations** for MS will be considered through the abandonment of the MS tri annual reporting obligations which have a limited added value compared to the administrative burden.

Based on the conclusions of the Top 10 consultation on administrative burden on SME's, specific measures should be foreseen to oblige MS (it is only a possibility in the WFD) to **exclude SMEs** producing or transporting non-hazardous waste in small quantities from any permitting obligation. This is a repeated and reasonable demand from SMEs when small quantities of non-hazardous waste are involved. In practice, it is proposed to include these simplifications in the WFD.

To ensure MS reinforce action to tackle the problem of littering, it is proposed to include a more explicit reference to **measures against littering** in the WFD, for instance in connection to the waste management plans that MS are required to establish under article 28 of the Directive but also in the context of the EPR schemes.

Measures to improve monitoring

Improving the **quality and validity of the reported statistics** is one of the key priorities identified by the vast majority of stakeholder as well as in the fitness check. On top of the continuous efforts to improve the quality and validation of the statistics undertaken by Eurostat, additional actions at MS level are needed. Two additional measures are proposed:

[53] The impacts of changing the measurement method are assessed under Option 3 – see below

- the creation of a **'National Registry'** on waste collection and management: several MS[54] have already put in place such registries with most of them being completely computerised. It has allowed eliminating major inconsistencies between National reporting bodies while improving the quality of the data collected.
- requiring **third party verification** before transmitting data and statistics to the EU particularly when legally binding targets are concerned – this will ensure that data transmitted are validated and conform to EU guidance.

In practice, it is proposed to include the obligation of establishing National registries and to ensure third party verification of key statistics in the WFD. A delegation should be given to the Commission to define more technical requirements. Also the Commission should organise exchange of best practices between MS. These measures corresponds to the unanimous stakeholder demand but also to Commission' concern to base its policy on reliable evidence. It is indeed essential to ensure that targets are properly monitored on the basis of a common methodology and with a reliable verification mechanism.

The reinforcement of the central role of the waste data centre of Eurostat in terms of gathering all waste related statistics including in relation to the attainment of the legally-binding targets will be considered. In that sense, all waste statistics - including those needed to assess whether the legally binding targets are met - should be directly reported to Eurostat. Whether the waste statistics regulation could become the sole instrument for gathering and validating all waste related statistics should be further investigated. In practice, it is proposed to include in the WFD the obligation to report all waste related statistics currently reported through the 3 annual reporting obligations (to be repealed – see above) directly to Eurostat. Additional guidance documents will be delivered, notably on how to report statistics on packaging and the recycling thereof.

Developing an **'Early warning' procedure** aiming at regularly monitoring MS performances against key legally-binding targets was considered as an appropriate measure by 92% of the respondents of the public consultation. It is indeed essential to identify well in advance of the legally binding deadlines those MS not making enough progress so that correcting measures could be taken on time. These measures could consist in taking concrete actions to ensure that best practices are progressively applied in the identified MS – including the application of key economic instruments at a sufficient level to enable to meet the targets on time. The waste management plans of the MS identified under this procedure should be evaluated by the Commission and additional measures such as for instance additional sorting requirements for C/D waste, additional measure on prevention, more public awareness, etc should be obligatory envisaged by those MS.

In practice, it is proposed to include the 'early warning' procedure in the WFD. With the support of the EEA and using notably the ex post and ex ante tools (modelling) developed by the EEA and the Commission, it is proposed to make regular assessment (every 3 years) and projections of MS performances and 'distance to target' in order to identify MS at risk of non-attainment of key targets (landfill diversion, packaging, construction and demolition waste, municipal waste). MS identified as 'at risk' should submit to the Commission a strategy aiming at meeting the targets on time.

Based on the experience of the most advanced MS and on the Roadmaps established during the compliance promotion exercise (see section 2.1), a list of measures to be envisaged by the MS in this strategy will be proposed. A dialogue will be organised between the Commission and the MS on the appropriateness of the proposed strategy. This approach will limit

[54] This notably the case in SK, CZ, BE, UK, AT, DE, NL but the list is not exhaustive

administrative burden while ensuring that appropriate measures are considered in the MS where they makes sense.

Measures to ensure the dissemination of best practices

As detailed in section 2 as well as in the fitness check, economic instruments are considered as indispensable to meet the EU targets. Nevertheless, imposing full harmonization of these instruments appears to be excessive and not useful for those MS making enough progress towards the targets.

It is therefore proposed to promote the **use of these economic instruments** through the 'early warning' procedure - see above - with a focus on those 'at risk' MS. The same approach should be followed to ensure that MS are taking the necessary measures for **'incentivizing' local authorities** to launch and intensify separate collection to increase recycling and reuse rates.

Establishing a systematic procedure to **evaluate** the adequacy of the **National or Regional waste management plans** will imply heavy administrative burden which is not justified for those MS on their way to meeting the targets. This systematic evaluation should therefore again be reserved for MS identified under the 'early warning' procedure.

In addition to the promotion of EPR schemes, measures to improve the cost efficiency of the schemes seem to be needed notably by ensuring a minimum harmonization between the national **EPR** systems. In line with most of stakeholder views, and in line with the conclusions of the fitness check, **minimum conditions** to be defined at EU level for insertion in the national ad-hoc legislation should be considered including measures to: clarify EPR definition, their scope, objectives and the responsibilities of the different actors; ensure that minimal enforcement measures are in place as well as a enough transparency, fair competition, with sufficient control and equal rules for all, and no distortion of the internal market; ensure that the fees paid by producer/importer to a collective scheme are reasonable and reflect the true and full cost for the end-of-life management of its product. **Additional guidance** should be provided to MS notably to ensure proper enforcement and combat effectively 'free riders', to ensure a fair competition, to ensure that exports of waste are in conformity with the EU legislation. In practice, it is proposed to include in the WFD minimum conditions that should be respected when EPR schemes are established by MS. This will be completed by guidance provided by the Commission on the best practices to establish cost efficient EPR schemes.

In order to ensure a **better use of EU structural funds**, and following the publication of the EU Court of Auditors report, the Commission has already adopted new rules for the use of structural funds for the period 2014-2021 including ex-ante conditions partly aligned with the recommendations of the Court. Four ex ante conditions have been defined in relation to waste management including the adequacy of the waste management plans and of the measures taken to meet the existing targets. The Commission is currently assessing whether these conditions are met or not for each MS. Additional measures, for instance, to promote the use of economic instruments to support the investments achieved with EU funds, are included in the proposed options of this IA.

Past experience[55] has demonstrated that structural funds are useful to help MS to meet the European targets but cannot be considered as an 'alternative instrument' to these targets. The European legislation and particularly the targets are providing the necessary frame to ensure that EU funds are properly used. As explained in the report form the Court of the Auditors, too much EU money (around 50%) has been invested in the lowest steps of the waste hierarchy (landfilling and incineration) and this is partly due to the lack of clear midterm

[55] Reference 13 in **Error! Reference source not found.**

perspective at EU level. Furthermore, the same report indicates that investments in sorting and composting infrastructure appear to be functioning at a low level of efficiency, potentially because of the poor linkages to appropriately-designed collection systems.

4.3. Option 3: Measures to upgrade the EU targets

Removing the targets from the legislation might be seen as a radical way of simplifying the EU waste legislation. In this IA, the added value of each individual target will be discussed and, where appropriate, it will be proposed to update existing targets, as well as to remove unnecessary or obsolete ones. New targets are only proposed if they are 'fit for purpose' and have a clear added value.

As explained in section 2.5.1 materials prices are fluctuating. They are not sufficiently attractive for all materials to cover the costs of separate collection and sorting activities needed to produce secondary raw materials. Waste streams are composed by different type of materials – some of them being profitable, others not and this changes over time. Targets are therefore necessary to ensure that waste is properly treated independently from material market fluctuations. This is absolutely needed to ensure that new investments will be accomplished on safe grounds in the waste management (recycling/reuse) sector.

As detailed in section 2.2, time is needed to change collections systems, ensure proper information of waste collection and management, build the required infrastructure and put in place appropriate economic instruments. It is therefore proposed to provide a medium term vision to the legislation by defining targets to be met at 2030 time horizon, with interim targets for 2020 and 2025. This will provide to the operator a clear signal on the investments to be achieved in the coming decade.

The stakeholder consultation has shown that this signal is awaited from the European Union. Apart from the fact that quantitative targets are indispensable to establish concrete and useful waste management plans, midterm targets will allow avoiding the mistaken made by some front runner MS having created over capacities of incineration (see section 2.5.1). It will also prevent the multiplication of low performing MBT facilities based on mixed waste collection and leading to high levels of landfilling.

In summary, midterm targets will clarify once for all the meaning of the waste hierarchy and will provide a stable context favouring investments in reliable and long term solutions based on high recycling/reuse rates and valid for several years. While some measures will be considered for other categories of waste, the focus will be on municipal, packaging and C/D waste since the management of these types of waste represents a good proxy to measure the overall performance of waste management: MS ensuring a proper management of their municipal waste have set in place a package of measures which benefit to all waste including public awareness, use of economic instruments, proper monitoring of waste generation and treatment etc. The main reasons for not considering other waste streams are summarised in Annex 6.

It is proposed to limit measures linked with construction and demolition waste to general measures detailed in Option 2 - improved statistics, limiting possible abuse on backfilling, early warning procedure. Reviewing the 70% existing material recovery target was rejected at this stage mainly because the priority is to ensure a sound implementation of the existing target but also due to the lack of 'stable' statistics on C/D waste – the statistical series being relatively recent. When there is more experience and better availability of reliable data, the target should be reviewed, including the possibility of material-specific targets.

Prevention and Re-use

Defining an **overall waste prevention target** and/or a target for **packaging prevention** appears to be attractive for some stakeholders (NGO's, academics, part of public authorities)

but not for others. At this stage it does not seem appropriate to define a legally binding weight-based quantitative target for prevention. There is a problem of timing as according to the WFD, MS are required to adopt by the end of 2013 National Prevention Programmes (NPPs) and it would be logical to assess the effectiveness of these Programmes before proposing any possible EU wide prevention targets. In addition, as highlighted in the fitness check, prevention for packaging waste seems difficult to implement and measure as the packaging materials, distribution systems and consumer demand are constantly changing. Nevertheless, evidence shows that efforts have been accomplished to limit the amount of packaging placed in the market notably under the influence of EPR schemes.

Nevertheless, progress in terms of prevention should be better monitored and compared at EU level. It is therefore proposed to define new indicators for waste prevention based on actual data on GDP and internal consumption linked to municipal and all waste generation. These indicators could be generated by the EEA, building upon Eurostat's data, on an annual basis and without any additional reporting obligation for the MS.

Notwithstanding the difficulties of setting waste prevention targets at the EU level – see Annex 6 - MS should be strongly encouraged to consider setting such targets within their own prevention programs, particularly for those MS at higher per capita income levels where, although recycling rates may be higher, consumption is also at much higher levels, leading to higher levels of waste generation. Regular inventories/benchmarking of prevention measures will be established by the EEA.

Defining prevention targets for specific waste streams or products having a higher environmental impact might be relevant, and a consensus has emerged to focus on food wastage. As there is a specific impact assessment on the sustainability of the food chain, this aspect will not be covered by the current IA. Promoting the use of EPR schemes and fixing minimum conditions notably on the application of the polluter pays principle will have some impacts on prevention: producer/importers will indeed be financially incentivized to place on the market better designed products generating less waste, as well as products which are easier to reuse and recycle.

Reuse will be encouraged through the proposed increase of the recycling/preparation for reuse targets both for municipal and packaging waste.

In conclusion, after having considered several options to review the targets, only the following options 3.1 to 3.7 were retained for further consideration in the context of this impact assessment. In order to properly assess the added value of each option, they were first considered in isolation (options 3.1 to 3.3 – increasing recycling/reuse rates for municipal waste, then for packaging waste, then imposing a landfill reduction). A combination of measures is then proposed into one option aiming at increasing recycling rates while reducing landfilling at the time (option 3.4). In order to take into account the large variety of performances between MS, different deadlines were applied to Member States (options 3.5 and 3.6). Finally, an extension of the landfill ban to all waste similar to municipal waste and sent in the same landfills is envisaged in option 3.7.

Municipal and Packaging waste

Options 3.1 - increasing the recycling/preparation for reuse target for overall municipal waste seems to be reasonable in the medium-term. The current target of 50% with 4 allowed measurement methods by 2020 should not be changed in order to maintain legal certainty.

The actual performance of some MS and regions in the MS indicates recycling/reuse rates between 70% and 85% are already achieved today see Figure 3 and Figure 9. On this basis, it is proposed to consider two levels of targets – 60 and 70% for further consideration. This corresponds to the level identified during the stakeholder consultation (see Annex 3), 84% of

the stakeholder felt that existing targets for municipal waste could be increased to an average of 70% with some differences between NGO's (80%), citizen (75%) public authorities (70%) and industry (between 65% and 70%). Tough similar levels were proposed by NGO's respondents from the 'less advanced MS'[56], the proposed levels were slightly lower for industry (62,5%) and public authorities (65%) originating from these MS.

As several regions and some MS have already met between 60 and 85% of re-use and recycling in 2011, meeting between 60 and 70% recycling is considered as feasible (see Figure 3 and Figure 9).

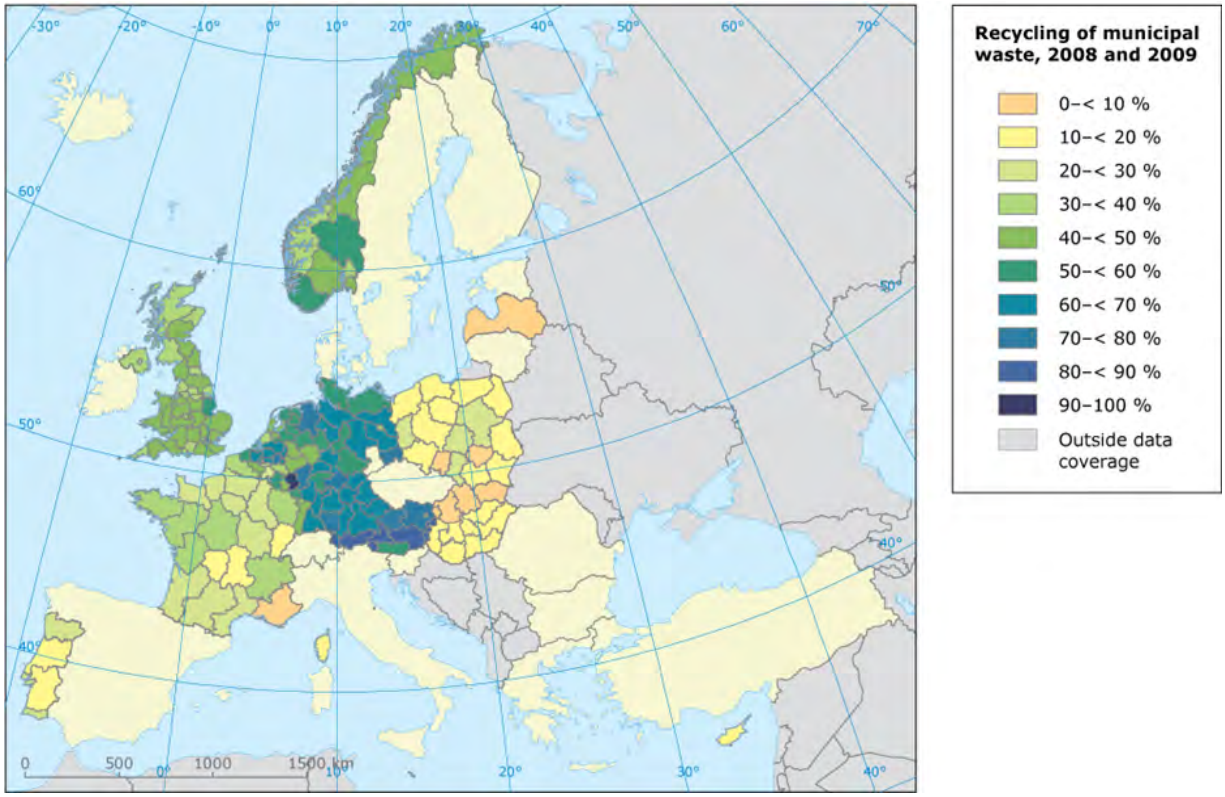


Figure 9: Recycling of municipal waste in EU Regions [57]

The large divergence in terms of waste management performance between different Member States has been taken into account to fix the deadline needed to meet the proposed targets: past experience in terms of increasing the recycling rates[58] - average increase of 2 to maximum 3% per year, indicates that a reasonable deadline for all MS to meet the higher proposed target would be 2030. For individual MS, this evolution can take place far quicker.

For example, the Flemish and the Walloon regions of Belgium moved from less than 20% recycling to more than 60% recycling in a period of 7 years. Generally speaking more rapid progress can be expected in the future: based on the experience of the most advanced MS, key instruments to favor recycling and reuse are well known – see section 2.5.1. Also new techniques in separate collection, automatized sorting techniques and recycling have emerged and should allow higher progress rates in the coming years.

Therefore, the following sub options were considered as a means to understand the relative merits of higher or lower targets:

[56] Less advanced MS were identified in a study of the Commission – see reference 6 in Annex 2. It includes BU, HR, CY, CZ, EE, GR, IT, LV, LT, MT, PL, RO and SK.

[57] Source: EEA reference 7, Annex 1. 2008 data were used for BE, DE, FR, HU, RO and Sl. 2009 data were used for the rest of the countries. Data were not available for MS in yellow and some uncertainties were identified for data from some MS (lack of common reporting methodology at regional level)

[58] See EEA report, reference 7 in Annex 1

	2020 (4 measurement methods)	2025 (only method 4)	2030 (only method 4)
Option 4.1 - Low	50%	50%	60%
Option 4.1 - High	50%	60%	70%

Table 6: Option 3.1: considered re-use/recycling targets for MSW

Option 3.2 – Packaging waste: As shown in Table 7 below, and in line with the conclusions of the fitness check, there is room to **increase the targets of the packaging waste Directive** in the medium term. Stakeholders also provided a clear indication that they believed the recycling targets for packaging waste could be increased. When asked what the highest level of recycling they believe could reasonably be achieved for the materials included in the current target, stakeholders provided the average response detailed in Table 7 with some differences between stakeholder categories (between 65/70% for all packaging for industry to 75% for public authorities and 80% for NGO's by between 2021 and 2024). Similar levels were proposed by respondents from the 'less advanced MS' except for NGO's for which the proposed levels were slightly lower (73%).

	Overall	**Paper and Cardboard**	**Glass**	**Metals**	**Plastics**	**Wood**
Recycling target	55.0	60.0	60.0	50.0	22.5	15.0
EU Average	61	83	68	68.5	37.2	38.6
MS Exceeding Target	21	26	19	23	26	25
Top 3 MS	75	96.3	96	93.8	61.1	81.1
Stakeholder views (2021-2024)	70	75	80	75	60	60

Table 7: Packaging recycling rates (%) per material, 2010 data and stakeholder views[59]

In line with stakeholder views, intermediate targets will be proposed in 2020 and 2025 though the 2030 targets will be fixed in the basis of the current performances of the most advanced MS – see Table 8. These targets should be progressively increased by 2030 and should be consistent with the targets fixed for municipal waste. Preparation for reuse should be taken into account in the calculation of the target.

The possibility to define additional targets for materials having a larger impact on the environment and on energy demand such as non-ferrous metals – mainly aluminum - will be analyzed (**Option 3.2- nonferrous)**. Some MS are indeed meeting the target on metal without making enough efforts on collecting/recycling aluminum at source.

The case of plastics is somewhat different: actual 'top 3' MS are recycling 61% of packaging plastics. According to the EU plastic industry, the target could be increased to 62% with additional efforts on source separation of waste.

Knowing the significant impact of plastics on the environment, it is proposed to increase the target to 45% by 2020 and to 60% by 2025. New mid-term targets should be fixed by 2030 on

[59] Source: Eurostat 2013

the basis of the evolution of the types of plastics placed on the market and the development of new recycling techniques.

The 2030 levels are considered as realistic as they were already met in at least 3 MS in 2011 though the 2020 and 2025 proposed targets are already met by several MS which is confirmed by stakeholder views. Even though differences of performances between MS is less significant for packaging waste than for other waste, these differences have been taken into account by fixing reasonable targets to be met in reasonable deadlines (15 years to pass from 55% recycling to 80% recycling/reuse). The alignment of the definition of the target (inclusion of preparation for reuse in the definition of the target) will also allow additional flexibility particularly relevant in the case of packaging (notably when considering reusable beverage packaging).

	2020	2025	2030
Overall recycling/preparation for reuse	60%	70%	80%
Plastics	45%	60%	To be reviewed
Non ferrous metal	85%	90%	90%
Ferrous metal	70%	80%	90%
Glass	70%	80%	90%
Paper/Cardboard	85%	90%	90%
Wood	50%	65%	80%

Table 8: Option 3.2 - Proposed new target for packaging waste

In order to **improve the quality of the recycling** and decrease the level of contamination of materials separately collected, a reinforcement of the at source separation provision will be envisaged, at least for the existing 4 materials targets in the WFD. The added value of imposing additional at source separation for other materials seems to be limited. Some flexibility should be left for the waste management organization according to local circumstances.

Option 3.3 will include measures to **limit landfilling to waste that is 'not recoverable '.** 6 MS already today are landfilling less than 5% of their municipal waste – which could be considered as corresponding to 'not recoverable waste'. The majority of MS landfilling the smallest percentage of municipal waste initially introduced landfill taxes followed in most cases, by landfill bans or restrictions applied on to various materials/waste streams.

It is therefore proposed to introduce a progressive ban on landfilling: firstly on the materials already targeted in the WFD by separate collection obligations in 2015 - plastics, glass, metals and paper/cardboard - followed by a ban on all 'recoverable' waste including biodegradable waste, wood waste, etc. In order to properly monitor the implementation of these bans, a landfill diversion target of respectively 25% and 5% corresponding broadly to the implementation of these bans on the basis of the average EU municipal waste composition would be proposed.

Introducing progressive landfill bans seems to be the most appropriate way of giving a clear signal to all actors involved in waste management in the European Union – which – according to the public consultation – is a clear demand from the vast majority of stakeholder. In addition, this approach might limit the risks of increased shipments of waste for disposal to MS where landfilling continues to be allowed for longer. As experienced in the most advanced MS, in order to move progressively in the direction of landfill bans which would be

the final aim, landfill taxes were introduced and progressively increased so that landfilling was more and more discouraged until it was reduced to few percentages.

As mentioned in the 7th EAP and during the stakeholder consultation, realistic targets should be defined in order to take into account variations between MS in terms of waste management. The experience of the most advanced MS[60] indicates that an average 3-5% annual landfill reduction could be met. Therefore in order to take into account the large differences between MS in terms of landfilling rates, it is proposed to fix realistic deadlines for the introduction of these bans: around 2025 (4 waste streams ban) and 2030 - wider ban. These targets and these deadlines are considered as realistic as already 5 MS are landfilling less than 5% of their municipal waste today, one MS (Estonia – see Box 3) has shown that dramatic reduction of landfilling could be met with the use of some ad-hoc economic instruments and as the time needed to reduce landfilling in the most advanced MS has been taken into account to extrapolate the proposed deadlines. This approach was also supported by all categories of stakeholders.

This new target to limit landfilling should progressively replace the existing landfill reduction target on biodegradable waste for which the latest deadline is 2020. Prolonging and reinforcing this 1995 based target on biodegradable waste will therefore be redundant and not justified also recognizing that its enforcement remains difficult to monitor due to the absence of an agreed definition of biodegradable waste.

Combination of measures

Under **Option 3.4,** a combination of options is considered. Options 3.1, 3.2 and 3.3 interacts indeed directly together: increasing the overall recycling/reuse rate for municipal waste can be achieved by increasing recycling of both the 'dry' fraction of the municipal waste – which includes a large share of packaging waste (between 30 and 40%) and the 'wet' fraction of the municipal waste – mainly organic waste (food waste, garden waste other organics). At the same time, increasing reuse/recycling rates of municipal waste up to 60 or 70% will mechanically have an influence on the landfilling rates of municipal waste. It therefore makes sense to combine these options into a package of measure and to assess their potential synergies. A summary of Option 3.4 is provided in Table 10.

As explained above in Section 4.4, these targets were fixed on the basis of what is currently (in 2010) achieved in the most advanced MS or regions thereof. Following this, on the basis of the past experience of the most advanced MS, the time needed to meet these targets by all MS was calculated to fix the deadlines. Therefore **no time derogation** is proposed in the initial Option 3.4.

Combination of measures, more stringent deadlines and differentiated approach

Fixing non uniform recycling targets for Member States taking into account the difference in terms of waste generation and composition, the current waste management performances or the potential contribution in terms of potential amounts of waste which could be recycled are options which was rejected for the following reasons:

- Even though there are differences in terms of municipal waste composition between Member States, the potential for recycling remain broadly equivalent and independent from waste composition: available recycling techniques cover a large spectrum of waste (from organic/wet to dry waste). Therefore there are no objective reasons to introduce different recycling targets based waste composition. In addition, this option would dramatically complicate the legislation and its enforcement;

[60] See references 1 and 7 in **Error! Reference source not found.**

- Waste generation is expected to increase in the coming years in several MS (albeit not necessarily coupled to GDP increases) particularly in those MS with lower levels of per capita income (past experience shows that stabilisation of waste per capita may be expected after a certain level of GDP/capita has been attained);
- During the stakeholder consultation, there was a broad consensus on the 'destination' to reach in terms of waste management (aligned to the objectives of the 7th EAP) but several stakeholder – including MS - insisted for having enough time to meet these objectives;
- Resource efficiency is an EU policy flagship of EU 2020 and should be promoted in all MS – there are no objective reasons to allow some MS to not make efforts to improve EU resource efficiency.

Nevertheless, as MS are not starting from the same level in terms of waste management – see notably Figure 3, it is proposed to consider **differentiated deadlines for MS** to assess the possible impacts of alternative trajectories to implement option 3.4 in a realistic way:

- Option 3.5: differentiated deadlines per group of MS based on their current level of performance
- Option 3.6: more stringent deadlines for all MS with the possibility of a 5 year maximum time derogation for some MS

To illustrate the possible impacts of a differentiated approach, a tentative grouping of the MS according to their level of performance is provided in Table 9 below. These options – summarized in Table 10 - will allow the possible benefits of improved waste management to be harnessed more rapidly in the MS where accelerated deadlines are achievable.

Group 1	Group 2	Group 3
7 MS landfilling less than 10% of municipal waste and recycling more than 40% (2010) AT, BE, DE, SE, DK, NL, LU	7 MS landfilling between 10 and 60% of municipal waste and recycling between 30 and 40% (2010) IE, SP, Sl, IT, FR, FI, UK	14 remaining MS

Table 9: Tentative grouping of the MS according to their performances

An alternative to Option 3.4 (Option 3.7) extending the landfill ban on all waste similar to municipal waste has also been tested. This extension might be easier to enforce at landfill gates and bring additional benefits in terms of recycling.

	2015	2020	2025	2030
Municipal overall recycling target				
Option 3.4 and 3.7	n/a	50% - all any method	60% - all one method	70%
Option 3.5- Differentiated deadlines	n/a	50% - Groups 1 & 2 one method only	60% - all one method	70%
Option 3.6 - Same deadlines + time derogations	n/a	50% one method Group 3 derogated to 2025	60% - all one method	70%
Landfilling				
Option 3.4			All - *25% max landfilling*	All - *5% max landfilling*
Option 3.5 - Differentiated deadlines	Group 1 *5% max landfilling*	Group 2 - *25% max landfilling*	Group 3 - *25% max landfilling*	Groups 2/3 - *5% max landfilling*
Option 3.6 - Same deadlines + time derogations		All - *25% max landfilling Derogations for Group 3 to 2025*	All - *5% max landfilling Derogations for Groups 2 & 3 to 2030*	
Option 3.7 – landfill ban extended to all similar waste			All - *25% max landfilling*	All - *5% max landfilling*
Ban on plastic, paper, glass and metals = (*25% max landfilling)* Global ban = *(5% max landfilling)*				

Table 10: Summary of Options 3.4, 3.5, 3.6 and 3.7

Actual and projected future performance rates in recycling are also important in light of the development of the **marine litter reduction target**, since recycling directly reduces the volume of waste which has the potential to escape into the (marine) environment.

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PART 2/6

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Proposal for a directive of the European parliament and of the Council

amending Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, 1999/31/EC on the landfill of waste, 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment

{COM(2014) 397 final}
{SWD(2014) 208 final}
{SWD(2014) 209 final}
{SWD(2014) 210 final}

Table of Contents

1. ANALYSIS OF IMPACTS

In this section, the main impacts will be first identified and some methodological elements to assess these impacts will be provided. Then the main impacts of the selected options under section 4 will be presented.

1.1. Identification of the main impacts

1.1.1. Economic impacts

Financial cost and savings of waste collection and treatment technologies

Achieving higher recycling rates will require changes to the collection systems operating in a number of MS as they move towards capturing greater quantities of material. In order to achieve the higher recycling rates, it is assumed that MS collection systems will have to evolve over time. For example, a MS may start with 'bring systems' focusing mainly on 'dry recyclables', but it is assumed that households will have to move progressively to door to door collection systems, insofar as this is possible, in order to target biowaste and to increase the capture rates of the dry recyclable waste.

At the same time, less and less mixed waste will be collected and treated, therefore the systems used for collection of mixed waste will have to switch to a lower frequency of collection, or move to a pay-as-you-throw system. This allows for savings to be made in the collection of mixed waste as either the collection frequency or the set out rate falls. At the same time, the cost of collecting recyclables becomes more costly as the system for collecting recyclables as well as biowaste becomes more comprehensive. Hence, on the collection side, there are opposing tendencies in the costs of collection: the costs of recycling increase, but the costs of residual waste collection fall.

This is illustrated in the following figure related to investigations in Lombardia in Italy. The combined bars indicate the costs of collection and treatment, with the green component related to waste collection, and the blue bar relating to the treatment of waste. This indicates how the average costs of collection per inhabitant barely change as one moves from systems delivering less than 20% recycling to those delivering more than 70% recycling.

On the other hand, as this happens, the expenditure outlay on treatment, particularly on residual waste, declines, so that those municipalities delivering higher recycling rates can achieved progressive savings on waste management costs.

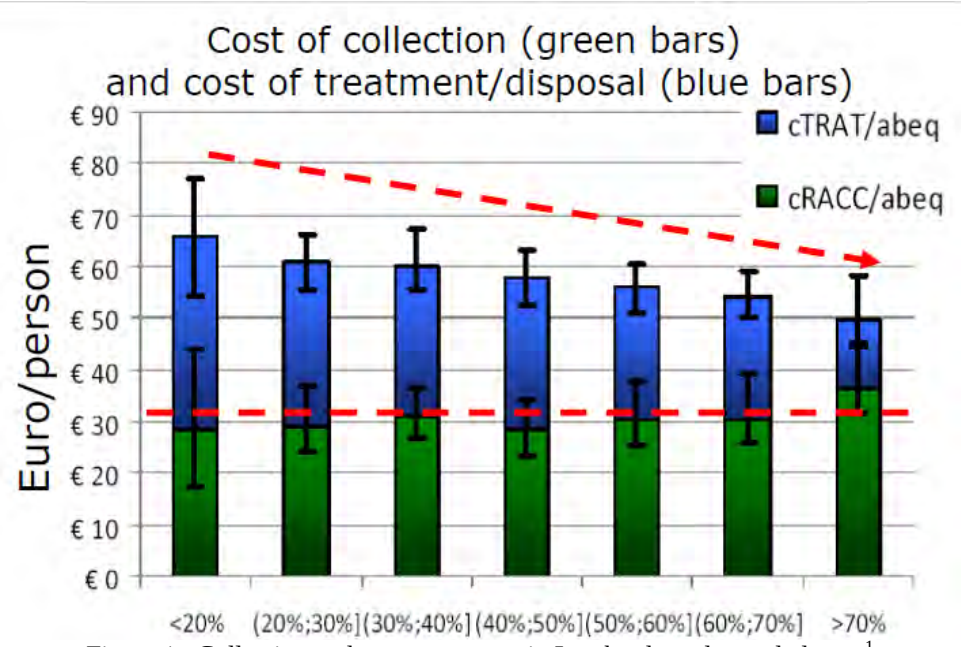

Figure 1: Collection and treatment costs in Lombardy and recycled rates[1]

The changing collection and treatment costs associated with this transition were assessed for each MS since many factors influencing the financial cost are specific to MS conditions - energy costs, labour costs, etc.

A summary of the main unit costs used for treatment in this IA is given in Annex 7 - Table 3-10: the 4 main categories of treatment (composting/digestion, incineration, MBT and landfilling) were divided between different sub treatment (4 categories for incineration, 5 for MBT and 3 for composting/digestion) depending on the technical characteristic of the treatment (for instance for composting/digestion: open air composting, in vessel composting or anaerobic digestion). For the 13 possible treatment technologies, specific unit treatment costs were calculated for each MS on the basis of several parameters including labour and energy costs.

The costs used in the model do not include taxes (e.g. landfill and incineration taxes) or subsidies (such as those on energy generation) as the objective is to assess the cost for society of the proposed options. In this IA, it has been assumed that the efforts needed to meet the proposed targets on Packaging waste will mainly be concentrated on municipal waste.

This reflects the assumption that systems will have prioritised the collection of commercial waste at an early stages since it has been demonstrated [2] that separately collecting and recycling secondary and tertiary packaging waste originating from commercial and industrial sources is easier to achieve – more homogenous waste streams from less waste producers, and even profitable in most instances. On the contrary, municipal waste is produced by a multitude of small mixed packaging waste producers which requires more collection and sorting efforts. This approach – which is confirmed in the fitness check - is considered as prudent, and could lead to an over estimation of the direct costs linked with the increased targets for packaging waste.

Additional possible costs of imposing new sorting requirements for the dry fraction as proposed in section 4.4 (separation of the 3 flows – paper/cardboard, glass and plastics/metals) should be compensated by savings linked with simplified sorting conditions

[1] Reference 1 in Annex 2 (part 3/3 of document)
[2] Reference 1 in Annex 2 (part 3/3 of document)

and improved quality/prices for recyclable materials due to the absence of cross contamination. Meeting the proposed targets will require an increased involvement of households in prevention and separate collection at source. No reliable method to monetise or even quantify this impact is available due to the large number of factors to be taken into consideration and the lack of generally accepted methodologies.

Access to raw materials

Similarly, it has not been possible to 'monetize' the impacts in terms of access to raw materials notably in terms of reduced dependency from imported raw materials. Nevertheless, the actual tonnages which could be recovered with the proposed option were assessed and are detailed in Section 6.

Administrative burden

In comparison to the full implementation scenario, no additional significant administrative costs have been identified linked with the increase of the targets. On the contrary, proposing a single measurement method for the target on municipal waste, removing the obsolete requirements of the PPWD like the maximum recycling target, aligning the main definitions, replacing the current landfill diversion target on biodegradable waste with an overall target which is easier to monitor, removing the overall recovery target from the PPWD will simplify the tasks of the MS.

Apart from the introduction of progressive bans on landfilling and the split between ferrous and nonferrous metals in the PPWD targets, no new types of target are proposed, and the possible additional efforts linked with the monitoring/enforcement of these new targets will be largely compensated by the proposed simplifications. More details are provided in Section 5.2 on the impacts on administrative burden of the proposed measures included in Option 2.

Functioning of the internal market

Some positive effects on the functioning of the internal market can be expected: for instance, measures to increase recycling and limit landfilling will 'naturally' push some MS having developed excess capacities for incineration to open their facilities to MS still landfilling significant amounts of waste. This movement has already been observed with an increasing amount of imported waste being treated for instance in Sweden, Denmark and the Netherlands. Recent information coming from the UK for instance clearly shows an acceleration of the trend in exporting waste to energy recovery facilities (waste exports from UK to EU passed from few tons in 2010 to more than 1 Million tons in 2013).[3]

Some countries, such as the Netherlands, are actively seeking to promote the utilisation of capacity at domestic incinerators so as to free up the potential for additional recycling. The new waste management plan in Denmark also, implicitly, seeks to reduce the amount of waste sent for incineration in the country through setting higher targets for municipal waste.[4]

Increasing recycling rates could also contribute to the expansion of the EU waste recycling market though the development of specific recycling industries for which a critical mass of recyclable waste is needed before investments are profitable.

Defining common principles for EPR will also have beneficial impacts on the internal market: today producers and importers placing goods targeted by National EPR systems on the EU market are facing significant different regimes.

The proposed harmonization will help reducing the differences between these regimes and therefore contribute to the fluidity of the market.

[3] Source: reference 1 in Annex 2 (part 3/3 of document)
[4] Source : reference 21 in **Error! Reference source not found.**

Competitiveness and Innovation- manufacturing sector

As explained in section 2.2, materials are one of the largest shares of input costs of European manufacturing companies - around 30 to 40 per cent of the cost structures.

In absence of solid forecasts on raw material prices, it has been assumed in this IA and in the model that raw material prices will remain constant (outside inflation) on time. This assumption is considered as prudent notably as regards the expected pressure on raw material demand and the recent raw material price changes - see **Error! Reference source not found.**.

At the same time, the implementation of the proposed Options will allow re-injecting secondary raw materials on the EU market which might influence the prices of raw materials for the EU industry. In the context of the IA, it has not been possible to assess the possible effect on the raw material prices of the production of additional secondary raw materials. These prices will remain dependent on several factors including the worldwide demand for raw material and their availability both from virgin and recycled materials.

Broadly speaking it can be assumed that fixing ambitious mid-term waste management targets now will help mitigate against the risks which might be associated with increasing prices for primary materials in future, potentially contributing to maintaining and improving EU industry competitiveness in the medium term. The production of additional secondary raw material in the EU will also attenuate EU dependency on imports of raw materials - some of them being considered as 'critical' in terms of availability.

In addition, improving the functioning of EPR schemes can bring additional savings for those placing goods on the EU market – including the manufacturing sector - see **Error! Reference source not found.**.

Competitiveness and Innovation- waste management sector

Several countries are implementing forward thinking strategies for managing waste in the future. EU companies either already are, or may become, exporters of technology or of services to markets outside the EU. A far-sighted approach to managing waste and resources is, therefore, expected to foster innovation and skills which make EU companies more competitive in non-EU markets.

This has been confirmed during the stakeholder consultation: the main EU worldwide companies involved in waste management and/or recycling activities are largely in favor of EU ambitious targets considered as one of the key driver for their business but also for innovation.

Competitiveness and Innovation- SME's

SME's active in the waste/recycling sector will benefit from the above mentioned impacts – notably in terms of business development potentials, safe access to raw materials, etc. SME's should be first in line to capture the potential opportunities linked with innovation and the development of new business models. Their flexibility has already allowed them to develop for instance new sorting techniques or business models based on application of the concept of circular economy. At the same time, meeting higher targets might imply for other SME's a short term increase of at-source sorting costs, at least in the lower performing MS in which landfilling and incineration remain more economically attractive. In the mid-term, the potential cost increase should be compensated by the saving achieved through better material management as a whole in the SME's. This would be all the more likely if material values continue to increase in real terms in future, as trends over the last decade indicate they may.

The proposed measures to simplify permitting procedures for SME generating or handling small amounts of non-hazardous waste should also allow for a reduction in SME's administrative costs.

1.1.2. Social impacts

Effects on employment

As detailed in Annex 6, Section 4.1.6, the upper tiers of the waste hierarchy (preparation for reuse and recycling) are much more labour intensive than disposal and incineration; thus, the movement of waste up the hierarchy is generally associated with an increase in employment opportunities. Based on changes in material flows the model allows for a high level assessment of the likely impacts that each option will have on employment.

In the EU as a whole, the potential employment opportunities will be greatest where the materials being collected and sorted for recycling are recycled within the EU. In this regard, it should be noted that where materials are collected for recycling in a manner which ensures the quality of the materials (source separation), it seems more likely that they will be reprocessed in the EU since EU disposal costs are already much higher than in those countries to which materials are exported: the lower costs of disposal can give countries an advantage where the quality of the collected materials is low (and hence, the proportion of contrary materials requiring disposal is high).

Social acceptance

Actions to promote prevention, infrastructures required to reuse and recycle waste are generally more readily accepted than proposals for new incineration or landfilling facilities. In many countries, citizens are willing to engage more actively in recycling, but the services available to them are not adequate. In the consultation, when citizens were asked whether they would sort out more wastes for recycling, 88% said they would, with food waste, textiles, non-bottle plastics and hazardous wastes among the most often cited materials that citizens would like to be able to recycle.

Notwithstanding the potentially self-selecting nature of the respondents to the consultation, this indicates a desire across EU citizens to recycle more (and more materials) than they currently do. This is also reflected in several so-called 'willingness to pay' studies seeking to elicit the strength of households' preference for recycling.[5]

Public health, safety, crime

It is assumed in the full implementation scenario that the existing Directives are applied and that, as a result, the impacts of waste management facilities are regulated. Clearly, where they are not, waste management can give rise to problems in terms of emissions to air, land or water, with related health consequences. The analysis of external costs in the assessment has included an assessment of the change in the damages associated with emissions to air, which constitute some of the main impacts on public health. The assessment has not been able to monetise damages associated with several other impacts of waste management, not least those associated with long-term impacts on water courses, for example. However, in the main, these indicate a positive effect on public health.

There are also potential public health concerns related to marine litter. Microplastics may contain persistent organic pollutants (POPs) or similar toxins. Ingested by marine life, these toxins have the potential to end up in the food chain. Waste management measures which reduce new marine litter inflows will mitigate these risks to some extent.

In a limited number of MS or zones of MS, waste management remains in the hands of uncontrolled groups managing waste in an illegal way which has led to a clear deterioration of the local or even international environment - illegal export of toxic waste outside the EU, for instance, or fires deliberately started at waste facilities. Measures aiming at improving the

[5] Source: reference 22 in Annex 2 (part 3/3 of document)

implementation of waste legislation can contribute to reducing those illegal activities: for instance improving statistics through centralised registries or applying economic instruments could contribute to identifying and combating these 'underground' activities. The lost revenue for the formal waste management sector is believed to be very large.

Similarly, improved registries and improved EPR schemes can contribute to reduce illegal shipment of waste outside the EU.

1.1.3. Environmental impacts

In this IA, both direct (linked with each treatment method and waste collection system) and indirect environmental impacts (avoided emissions/impacts due to the 'non-use' of virgin raw materials, energy produced in energy recovery facilities) were assessed and as far as possible quantified. It includes an assessment of GHG and air pollutant emissions, impacts on marine litter, and benefits of improved soil structure and nutrient supply. The environmental impacts were assessed assuming that all installations are in compliance with the existing relevant Directives and notably the Landfill and the Industrial Emissions Directives.[6]

Direct GHG and air pollutant emissions from waste treatment

Environmental damage associated with emissions to air were assessed. The model defines the damage costs for GHGs and a number of air pollutants and also identifies what emissions are likely from a comprehensive range of waste treatment and disposal technologies. In this way, the costs of damage can be calculated depending on the quantity of waste being treated via each form of technology. Further details of what is included and excluded from the environmental damage cost calculations is provided in Annex 8, section 3.1.5.

Marine litter

Improved waste management will have an impact on the presence of both terrestrial and marine litter. For most sea regions, up to 80% of litter is transported there from land by rivers, drainage or wind.[7] Plastic waste is particularly problematic, consistently making up over half of marine litter in all four marine regions, and in some cases accounting for over 80% of marine litter.[8] Increasing recovery rates will mean higher volumes of waste are captured within appropriate management systems, which is likely to bring about a decrease in new debris entering the marine environment.

Many of the most common items of marine litter are fully recyclable, e.g. plastics bags, plastic bottles, bottlecaps, beverage cans, plastic cutlery. However, these items are frequently not being recycled, and instead end up as marine litter. Waste which is recycled into new products never ends up as marine litter. If the right incentives/policies are put in place to drive recycling rates (everything from an EPR scheme which gives consumers an incentive to return a plastic bottle to ensuring the availability of recycling facilities/separate waste collection to make the recycling choice an "easy" one), then by definition, much of the waste currently "at risk" of becoming marine litter is taken out of this category and reused as secondary raw materials for new products.

As detailed in Annex 7, a specific module was added to the modelling tool to assess the possible impacts of improved waste management and revised waste-related targets on marine litter.

Impacts not quantified

[6] Directive 2010/75/EU on industrial emissions, OJ L 334, 17.12.2010, p. 17–119

[7] Reference 23 in Annex 2 (part 3/3 of document)

[8] Issue Paper to the "International Conference on Prevention and Management of Marine Litter in European Seas"http://www.marine-litter-conference-berlin.info/userfiles/file/28-03-13_Issue%20Paper_Version%20to%20be%20discussed%20at%20the%20conference.pdf

Due to the lack of available methodologies, it has not been possible to quantify the following impacts:

- Those associated with the production of leachate and waste water from all the processes
- Effects of odour and bio-aerosols from landfilling, composting and anaerobic digestion processes, as well as other nuisances such as insects and vermin;
- Estimation of the financial disamenities linked with living in the vicinity of waste treatment facilities as well as impacts on landscape

While the data on both the magnitude of disamenities and their possible valuation are inadequate, it is assumed that these impacts are likely to be relatively small as it has been assumed that all plants are supposed to respect the EU relevant legislation.

1.2. Impacts of the key options

The key impacts – financial and environmental costs, the net social costs as well the impact on employment have been assessed for each options identified in Section 4.

The added value of each option is presented against the full implementation option which is considered as the starting point or the baseline in the context of the IA.

Nevertheless, in order to get a complete analysis, the business as usual scenario was used as the basis to assess the added value of ensuring the full implementation of existing legislation.

Option 1: Full implementation

As detailed in Figure 2 below, moving from the business as usual scenario to the full implementation scenario implies an increase of recycling by over 5 % across the EU whilst landfilling falls by a corresponding amount.

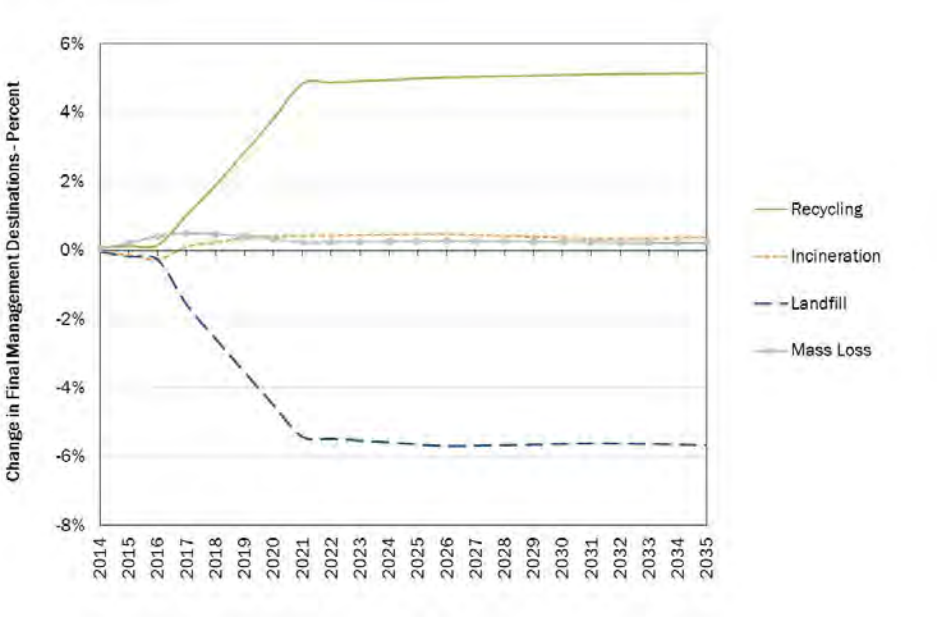

Figure 2: Changes in mass flow - Full implementation vs BAU scenario (% - EU 28)

Financial Costs

A comparison of the full implementation scenario against the BAU scenario indicates that significant investments will have to be made between now and 2020 if MS are to be fully compliant with the targets. These costs are largely associated with investments required to improve collection services mainly in the larger countries (notably ES, PL, CZ, GR, RO, SK)

where there appears to be a large gap between then BAU scenario and the demands of full implementation.

Generally speaking, it is assumed that existing predominantly bring-based collection infrastructure in the lower performing MS will have to be partly and progressively supplanted by a door-to-door collection system where this is feasible to ensure higher capture of recyclable waste. At the same time, the existing bring-based collection systems may have to be intensified (increasing the collection points) and adapted (buried collection points in urban zones), with intensive communication campaigns used to support use of the services. Investments in new collection trucks will be needed as well as, depending on system choice, new sorting centres and composting or digestion facilities. In this first phase, significant efforts of communication will be needed to change citizen behaviour. As explained before, there is a large variety of tools available for MS to cover the costs associated with this first investment phase – EPR schemes notably have demonstrated their importance to launch the necessary dynamic and to provide additional source of funding for this necessary first phase of intense investments.

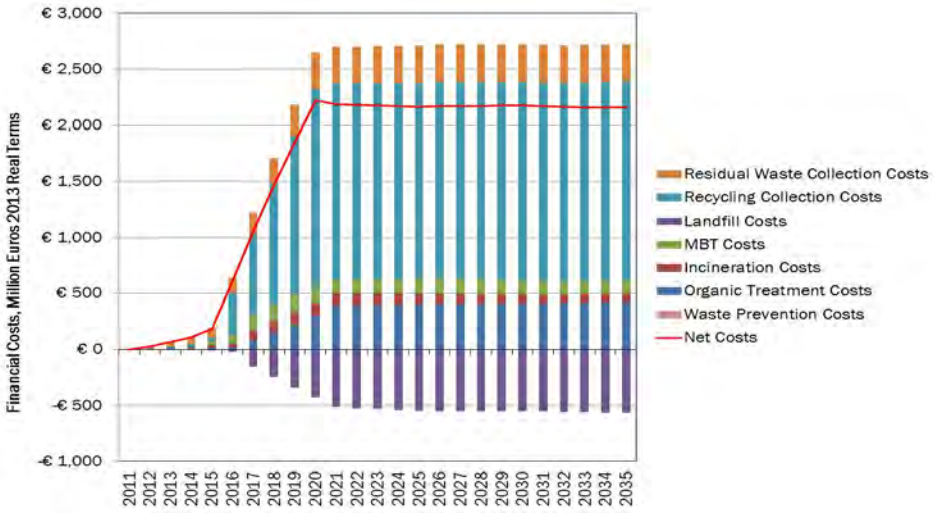

Figure 3: Full implementation vs BAU scenario - Financial Costs (million € - EU 28)

Figure 3 should be nevertheless interpreted with caution as it assumes that no efforts would have been accomplished by MS between 2011 and 2016 to meet the targets – which is an hypothesis taken in the model in absence of verified statistics for the years 2012-2016.

In addition, some of the savings identified under the following options 3 (see below) might also appear earlier in some MS even though experience shows that before capturing savings from diminishing residual waste collection there is a first phase where both collection systems (mixed residual waste and separate recyclable waste) are necessary – leading to increase costs during the first period of changes.

Environmental Costs

There are clear environmental benefits to be gained from full implementation. The majority of these benefits are realised prior to 2020 when the 50% recycling target and the final Landfill Directive target have to be met; however, the benefits continue to accrue steadily over time once full implementation is achieved. It is estimated that full implementation of the existing targets would lead to a reduction of 4,6% of new marine litter inflow by 2020. However, without further action, new marine inflow would increase by 2,9% by 2030. It is important to reiterate that not all the environmental benefits can be monetised, not least those associated with reduced marine litter. Research undertaken in specific circumstances does indicate, however, that the benefits from reducing litter in the terrestrial environment are potentially very significant indeed – see section 5.1.3.

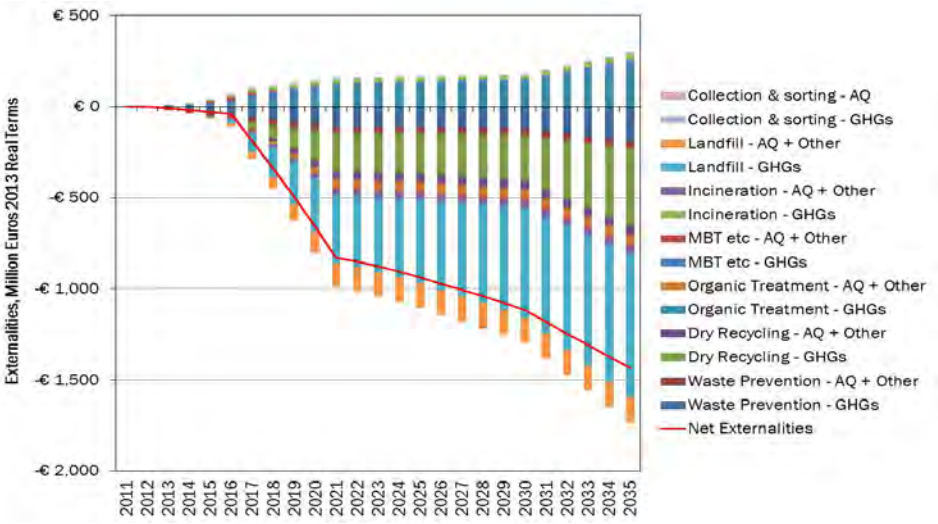

Figure 4: Full implementation vs BAU scenario - Externalities (million € - EU 28)

Net Social Costs

As shown in Figure 5 below, there is a net cost associated with full implementation relative to the Business as usual scenario as the cost of implementation outweighs the environmental benefits. The overall picture, however, shows that the net cost will progressively decrease over time (from €1.500 million to less than €600 million across the EU28). Again this Figure should be interpreted with care: as explained savings will progressively appear with the intensification of separate collection and higher recycling rates. More and more waste will be recycled and less and less residual waste will have to be collected and treated. In a first phase, these savings will be modest as both collection systems (separate and mixed) will have to be maintained. But in the longer term, and if efforts are made to further increase the capture of materials for recycling, the efficiency of logistics will improve, revenues from material sales will (other things being equal) increase, and spending on treatment / disposal will also increase. Net costs would then be expected to fall (see below).

In summary, it is assumed that this first phase of investment linked with the achievement of the existing targets requires a significant shift in the collection and treatment modes as well as in the way of managing waste for citizen. This implies additional costs with limited savings and benefits as the recycling rates remain relatively low, and logistics are not fully optimised so that the full benefits from a re-organisation of the system are not realised.

Figure 6 below shows the costs and benefits per MS. As explained above, some MS (notably ES, PL, CZ, GR, RO, SK) will have to upgrade their current waste management systems to ensure the full implementation of existing target without immediately capturing potential savings and benefits. It is important to note that the increase in cost reflects the standpoint of a cost-benefit analysis (CBA), and that the costs of landfilling, for example, do not include (as is conventional under CBAs) landfill taxes. As such, the 'avoided costs' from 'not landfilling' are relatively low, and reflect what are often still quite low costs of landfilling in the different MS.

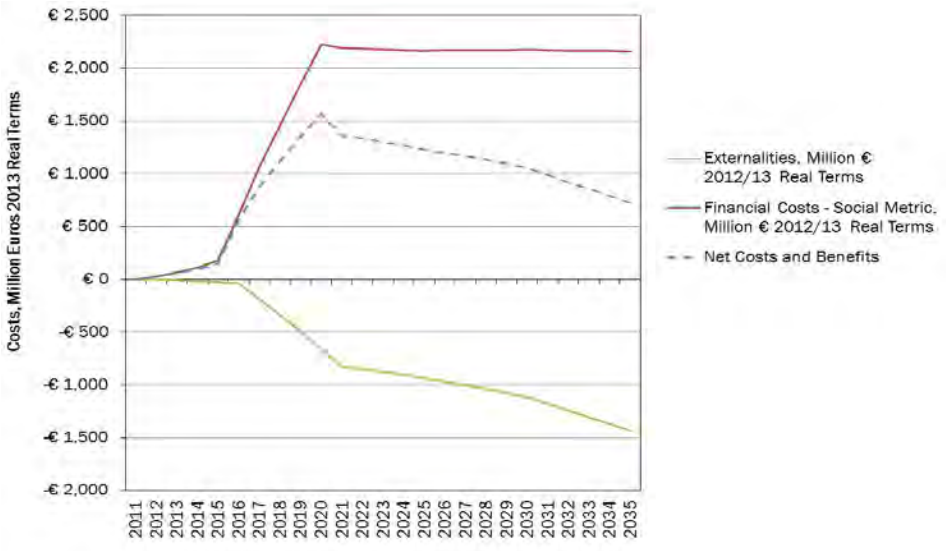

Figure 5: Full implementation vs BAU scenario – Net Social Costs (million € - EU 28)

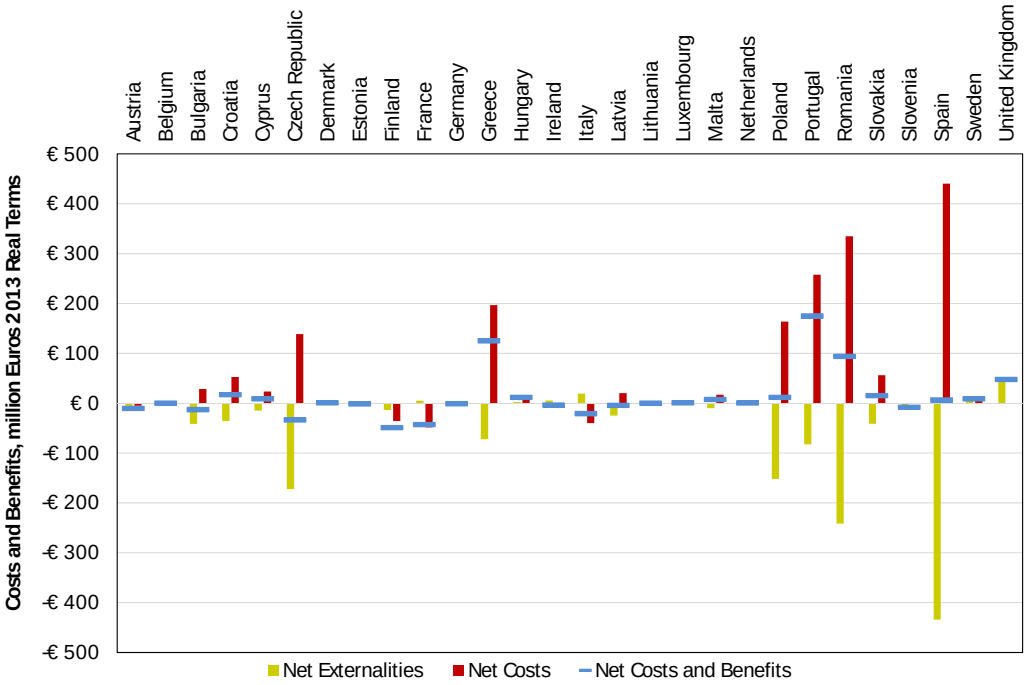

Figure 6: Full Implementation vs BAU – Net Social Costs by MS in 2030

Employment

Compared to the BAU scenario, this scenario also leads to an increase in employment. The estimated increase in direct employment is 36,761 FTEs (Full-time equivalent) at EU 28 level. Most of the jobs will be created in the larger MS having to make additional efforts to meet the existing targets (SP, PL, PT, RO, SK and CZ).

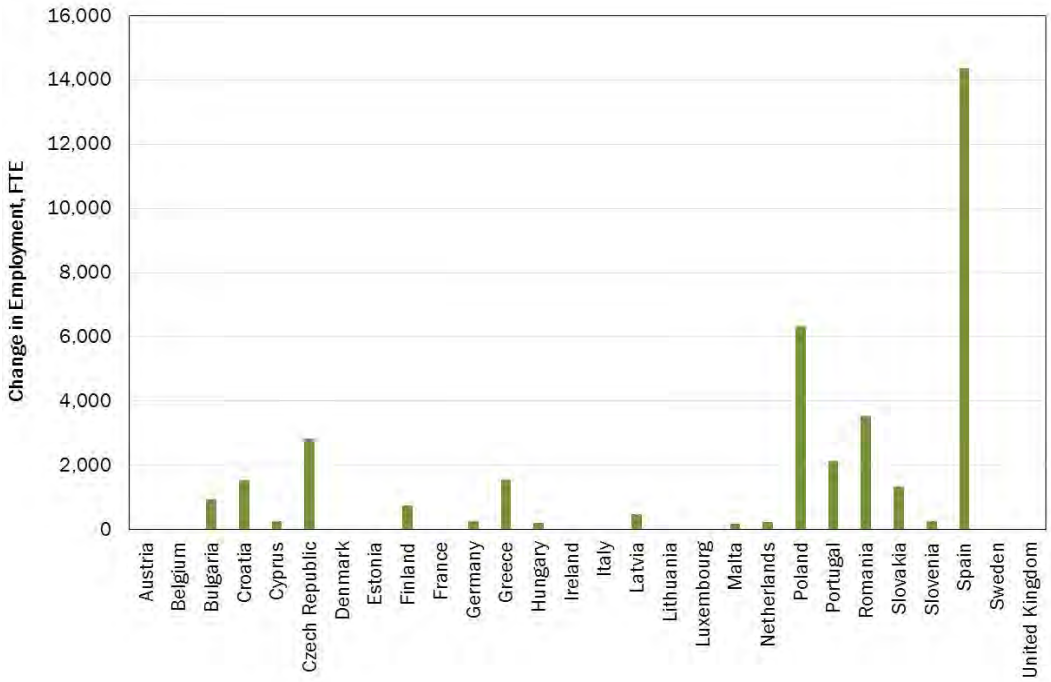

Figure 7: Full implementation vs BAU scenario - Changes in employment by 2030

Option 2: Measures to simplify the legislation, ensure proper monitoring and disseminate best practices

Managing the proposed **'early warning system'** will require additional efforts both for the Commission and the concerned MS notably to identify the MS 'at risk' of non-attainment and to ensure that the appropriate measure are taken on time to meet the targets. The Commission with the EEA has developed a modelling tool which will be permanently maintained notably for that purpose. In addition, Roadmaps have already been produced by the Commission for the 10 least advanced MS[9] which includes clear and tailored recommendations to improve the waste management. With the early warning procedure, the focus will be limited to those MS for which there is a clear added value of requiring additional information with the perspective of limiting possible infringement procedures later. Managing the early warning procedure will represent an additional workload for the EEA (identification of MS at risk) and for the Commission (launching a dialogue with the 'at risk' MS on the required measures to meet the targets). Nevertheless, in the light of the existing information and tools (roadmaps and modelling) and knowing that the Commission has already taken initiatives to promote compliance, it has been estimated that this workload could be covered with existing resources through a slight adaptation of the work priorities.

Measures aiming at **improving statistics** will require additional efforts by some MS who have not yet developed tools to assist with this. This is the case for the **establishment of National waste Registries**. The additional costs and potential savings are extremely difficult to assess for each MS: all MS have indeed already in place a system of data collection for waste management as they have to report these statistics to Eurostat and to the Commission. During the country visits carried out at the occasion of the compliance promotion exercise, it has been established that some MS have set in place parallel systems of data collection leading to significant differences in terms of waste generation, collection and treatment between for instance the National Environment Ministry and the statistical Agency. [10] In the case of these countries, establishing a centralised registry could only lead to savings despite

[9] See Reference 6 in Annex 2 (part 3/3 of document)
[10] Reference 6 in Annex 2 (part 3/3 of document)

the initial investment which will be needed to set up the registry. In other MS these registries are already in place since several years. No additional costs are expected for these MS.

In fact, in the midterm all MS should capture savings from the establishment of a centralised waste management registry. The example of Austria shows that additional level of sophistication could lead to additional significant savings not only for the public authorities but also for waste operators. For instance, the Austrian system is designed to cover a number of environmental fields and is reported to cost around €4.5 million per year. Of this, €750,000 to €1,500,000 is reserved for the on-going development of waste related components. According to the Austrian Chamber of Commerce, this system helps to reduce the administrative burden of reporting and has helped to reduce costs by between €4 million to €10 million.[11]

Imposing a third party verification will represent a cost for Member States. Nevertheless, these additional efforts should be compensated by the proposed **dramatic simplification of the reporting flows**. Re-investing these means into improving statistics, better monitoring of MS performances and ensuring the dissemination of best practices with a proper management of the early warning procedure seems to be largely justified.

A broad estimation has been made of the effects in terms of administrative burden of the proposed measures under Option 2 – see Table 1. It has been estimated that establishing tri annual reports by the MS requires around 45 working days for the WFD (30 days to establish the report and 15 days of additional follow up) and 30 working days for the other Directives[12].

Compiling the information from all MS and producing a report from the Commission to the European Council and the Parliament requires approximately 120 days (15 days to establish the report, 30 days to check the data reported by MS and ask additional questions, 60 days for translation of the incoming 20 pages reports from the MS and the report produced by the Commission and 15 days for the adoption procedure). [13] This means an annual average of 40 days.

The time needed for the third party verification procedure has been estimated at 5 man days per year for the key statistics with the exception of packaging for which additional verifications are needed notably on data of packaging placed on the market. In principle, these verifications should decrease the work load at Eurostat level as part of these verifications is carried on by Eurostat. Nevertheless, more actions will be undertaken by Eurostat to ensure the reliability of the data collected therefore these savings are more hypothetical.

All in all as shown in Table 1 below, the global balance of the proposed measures under Option 2 seems positive leading to an annual average reduction of 10 working days for the MS and 60 working days for the Commission. These results are broad estimates and should be taken with precaution; the reality could vary from one MS to another in positive or negative terms depending on the actual situation in each MS. In this table, all data were reported on an annual basis, the time needed to establish the tri-annual reports was therefore divided by 3.

Proposed initiative	**Man/days/year** **Member States**	**Man/days/year** **Commission**

[11] Reference 1 in Annex 2 (part 3/3 of document)
[12] Source: contacts in Member States
[13] Based on Commission past experience

Tri annual reports		
Waste Framework Directive	- 15 per MS, – 420 for EU 28	
Landfill Directive	- 10 per MS, -382 for EU 28	
Packaging Directive	-10 per MS, – 280 for EU 28	
Report from the Commission		- 40
Third party verification		
Municipal waste statistics	+5 per MS, + 140 for EU 28	
Landfill statistics	+5 per MS, + 140 for EU 28	
Packaging statistics	+10 per MS, + 280 for EU 28	
Construction and demolition waste	+5 per MS, + 140 for EU 28	
Verification at EU level		(-20)
Total	- 10 per MS, - 280 for EU 28	- 60

Table 1: Estimation of the annual impacts on administrative burden of Option 2

As it is proposed to introduce at the same time a package of measures aiming at simplifying reporting obligations while improving the quality of the statistics (third party verification and National registries) and as the main impacts of these measures were assessed in this report (no significant impacts identified), it is not the intention of the Commission to undertake separate impact assessments when the technical requirements (third party verification and National registries) will be later defined through delegation.

Defining **minimum condition for EPR** schemes might contribute to reduce the costs of the EPR systems while ensuring higher recycling and reuse levels. As detailed in section 2.3.3 some MS have managed to increase the recycling rate for packaging waste to levels similar to the proposed targets for 2030 while ensuring a level of fee to be paid by the importer/producer and at the end by the consumer lower than in other less performing MS. It might therefore be expected that when a minimum level of harmonization is ensured, the cost effectiveness of most of the existing EPR will progressively improve. The elaboration of guidance on best practice at EU level can also contribute to the cost effectiveness of the systems.

For instance, it has been estimated that the full cost coverage of household packaging in Belgium through the EPR systems represents around €7.90[14] per year per capita for an average recycling rate of 85 % which is the highest in the EU. According to the available data, these costs vary from €5.50 € per year and per inhabitant to €19.70/year in the other MS – all of them meeting lower recycling rates. When comparing the fees paid by producers/importers per ton of packaging material put on the market, similar discrepancies appear: average fees charged to producers range from €14/ton to €212/ton (€21/ton in BE), with an average of €105/ton. In addition, in Belgium – like in some other MS – a specific budget is reserved to combat littering originating from packaging – around € 2M in 2012. In the NL, this amount raise to €20 M per year or €1,19 per year and per inhabitant.[15]

[14] Source: reference 5 in Annex 2 (part 3/3 of document), 2011 data; due to higher material prices, this cost was even lower in 2012

[15] Source: Annex 7 (part 3/3 of document)

Option 3: Upgrade EU targets

In order to compare the added value of upgrading the EU targets, the basis for the comparison of Options 3 is the full implementation scenario. Therefore, all the results provided in this section are relative to the full implementation scenario.

Option 3.1: Increased municipal waste recycling and preparation for reuse targets

As detailed in section 4, two levels of targets have been considered:

- First a low level of 60% by 2030 (Option 3.1 – low)
- A high level of 70% by 2030 (Option 3.1 - high)

The main results are detailed below:

Option 3.1 – Low: Increased MSW Targets at 60% in 2030

As shown in Figure 8 below, compared to the full implementation scenario, Option 4.1 (low) implies a progressive increasing of recycling of 14% while at the same time landfilling and incineration are progressively reduced by 5%. The mass loss line represents losses from MBT processes, the use of which is also significantly reduced. These effects occur because in some countries, investments in incineration and MBT are made in the full implementation scenario, so the higher target effectively forestalls some of the investment in incineration and MBT in some countries.

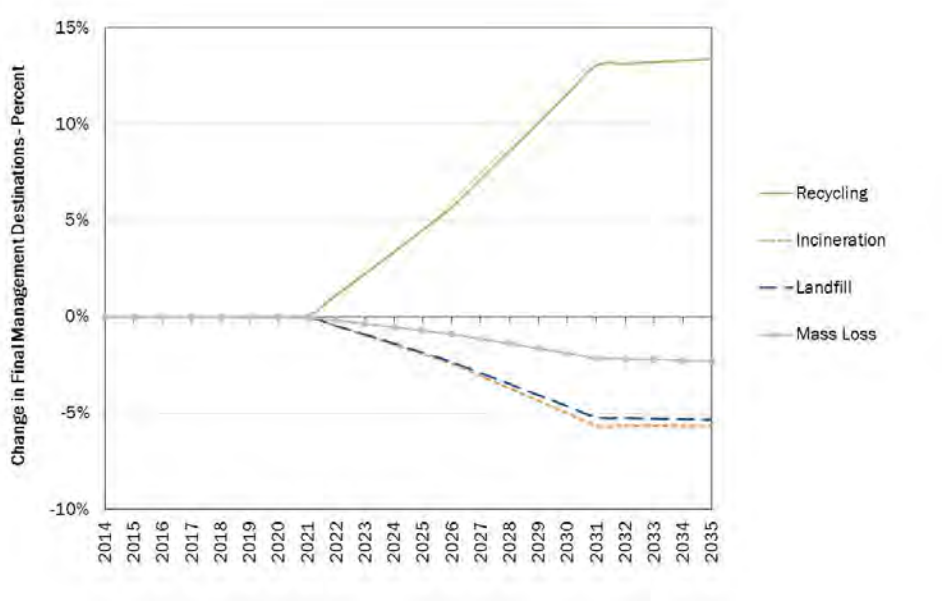

Figure 8: Option 4.1 low – Mass flow changes (% relative to full implementation, EU 28)

Financial Costs

Under this Option, the overall costs for the MS become negative as from 2020. This is a result from the avoided costs of waste being collected and treated as residual waste: more and more waste is diverted from mixed door to door collection systems into a combination of bring and door to door separate collection system which allow progressive savings.

The modelling assumes that in the full implementation scenario, many countries have already had to invest significantly in the upgrading of collection services relative to the situation they were in in 2011 (the latest year for which data is available).

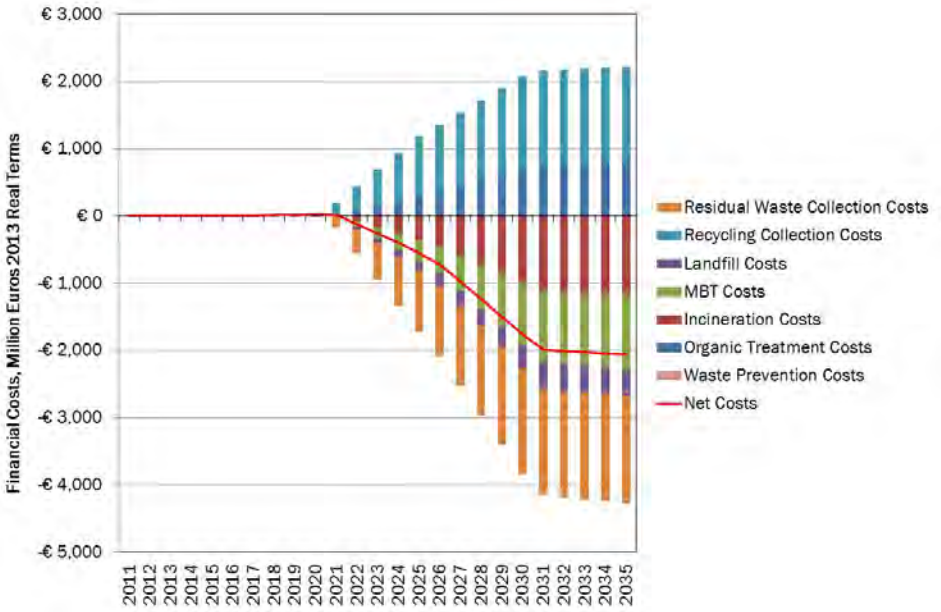

Figure 9: Option 3.1 (low) - Financial Costs (M€ - relative to full implementation, EU 28)

In moving to higher recycling rates, the capture of materials for recycling increases and the revenue generated from the sale of materials increases (so the costs, net of revenue generation, decline). At the same time, the quantity of residual waste requiring collection and treatment declines leading to reduced frequency of refuse collection and savings on the delivery of the collection service. In summary, the effect of measures which encourage/ incentivise the use of the services for recycling is to improve the efficiency of the logistics, and capture more revenue from each household. This explains the effect on collection costs in this and other high recycling scenarios in this impact assessment

Environmental Costs

There are significant benefits derived from the recycling of more material. The majority of these benefits are associated with the avoided GHG/Air emissions related to recycling but other significant benefits result from avoiding GHG and air pollutant emissions from residual waste treatment and disposal.

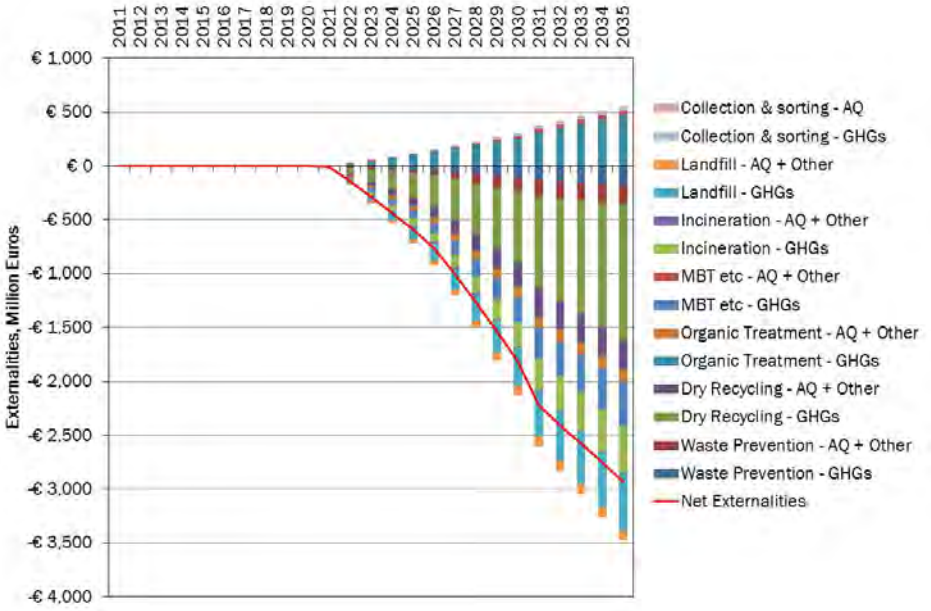

Figure 10: Option 3.1 (low) - Externalities (M€, relative to full implementation, EU 28)

Net Social Costs

With both the financial and environmental costs proving to be favourable relative to full implementation it is no surprise that the net position of Option 3.1 Low is very favourable – see Figure 11. The benefits exceed the costs in all years, though only marginally so in early years.

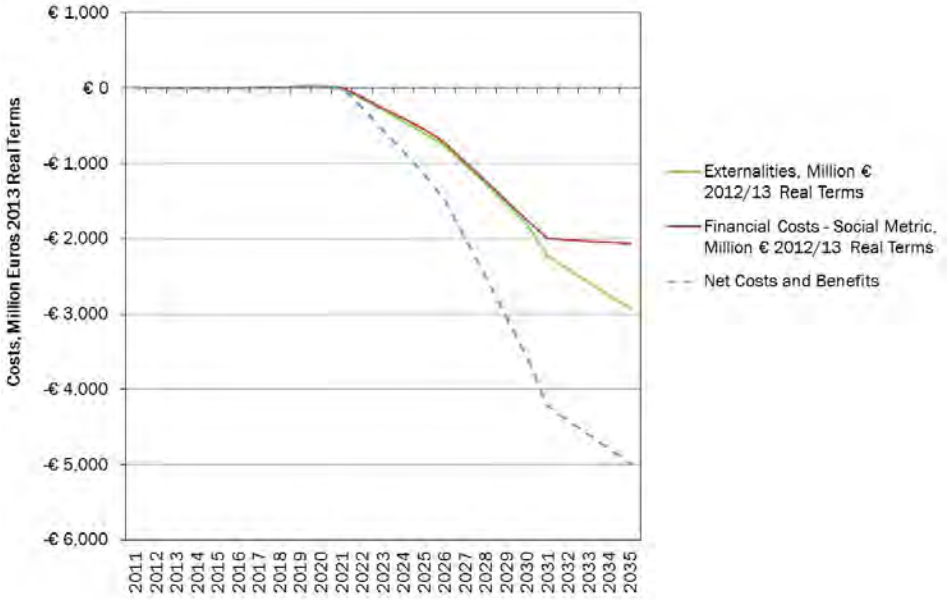

Figure 11: Option 3.1 (low) – Net Social Costs (M€ relative to full implementation, EU 28)

Employment

This Option also leads to an increase in employment. The estimated increase in direct employment is 78,519 (FTE – Full-time equivalent) across the EU. The effects in each MS are shown in the Figure below.

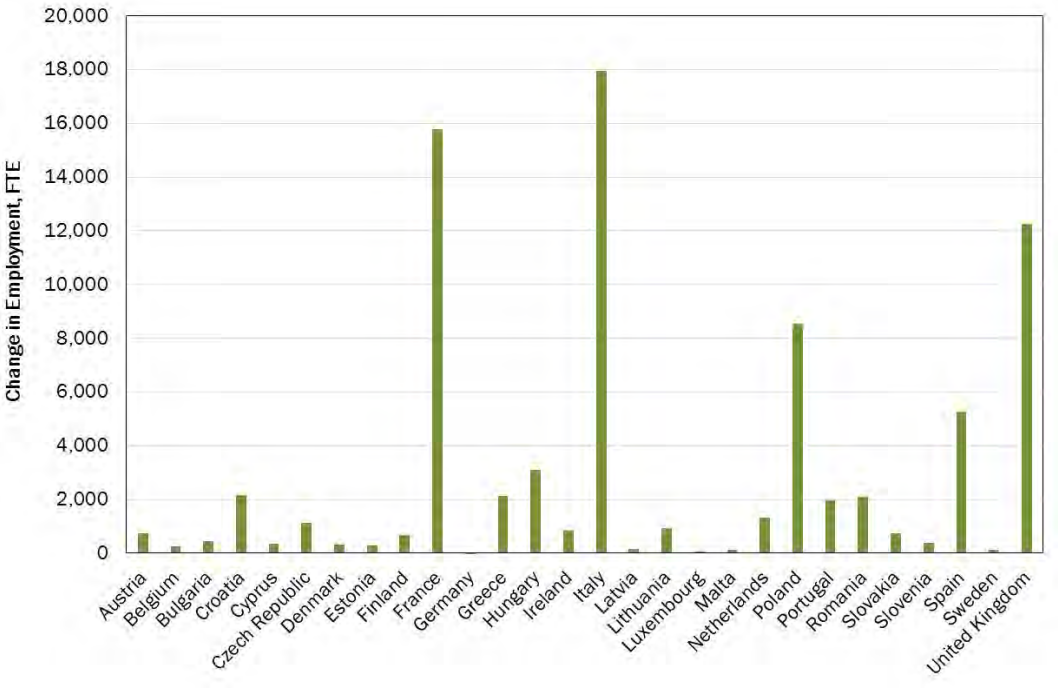

Figure 12: Option 3.1 (low) – Employment change relative to full implementation by 2030

Option 3.1- High: Increased MSW Targets at 70% by 2030

Compared to the full implementation scenario, Option 3.1 (high) implies a progressive increase of recycling up to 70%. In this case, a higher proportion of the switch, relative to full implementation, comes from reducing incineration (and MBT – indicated, in part, by the change in 'mass loss', which is associated with this management method).

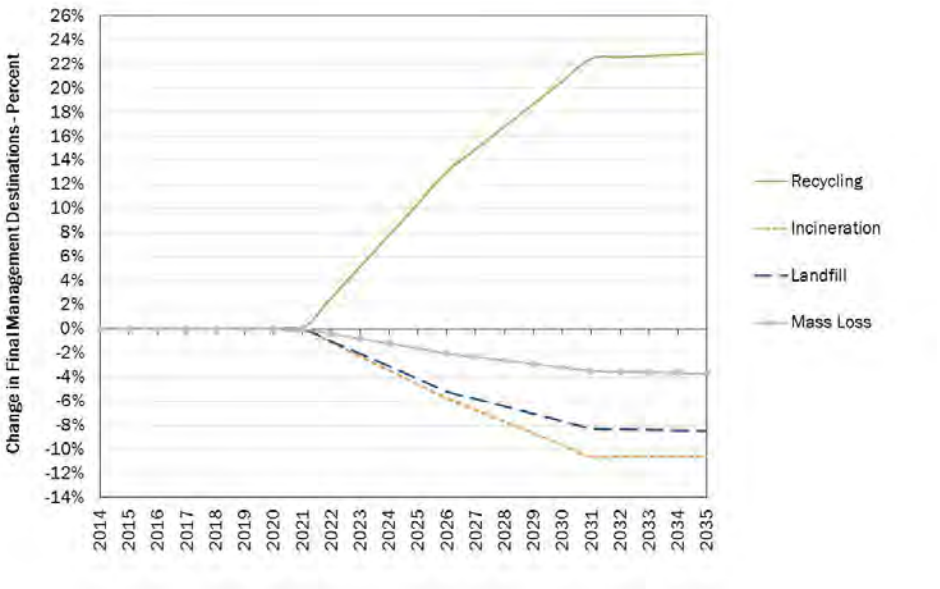

Figure 13: Option 3.1 low – Mass flows changes (% relative to full implementation, EU 28)

Financial Costs

Under this Option, as for the previous one, the overall costs for the MS are negative. This is as a result of significantly reduced residual waste collection and treatment costs. However, the effect is more pronounced than in Option 3.1- low for obvious reasons.

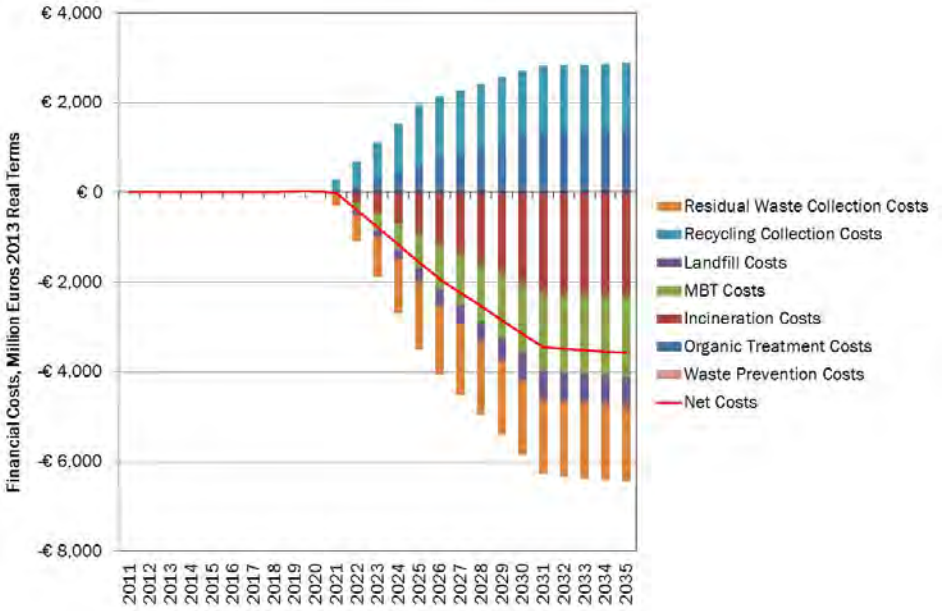

Figure 14: Option 3.1 (high) - Financial Costs (M€, relative to full implementation, EU 28)

Environmental Costs

The environmental benefits from this Scenario are higher than those achieved under the previous Option, and they are also delivered earlier in time. This option sees new marine litter inflows which are 10% lower than those projected under the full implementation scenario.

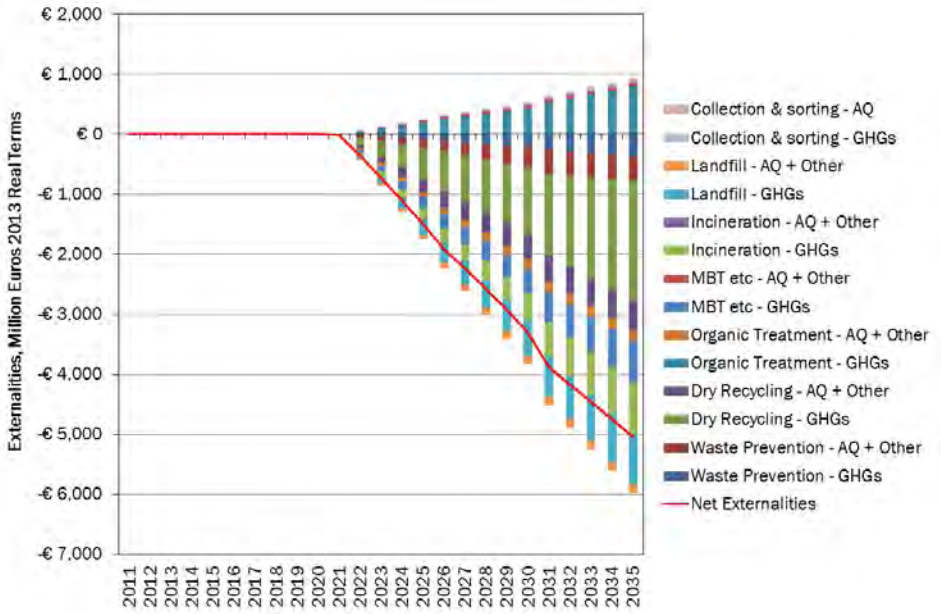

Figure 15: Option 3.1 (high) - Externalities (M€, relative to full implementation, EU 28)

Net Social Costs

At the level of the EU28 net position is even more favourable than under the 60% recycling Option as the benefits are higher, and the increase in benefits exceeds the additional costs - see Figure 16. However, one of the issues with this Option is that it might represent a challenge to some countries to achieve the targets even if as explained in Section 4.4 some EU Regions have already met higher recycling rates in 2010. A more detailed view of the Net Present Value (2014 – 2030) of the costs and benefits for each MS are shown in **Figure 17**. All countries expect RO and PL will experience a net social benefit (i.e. negative costs).

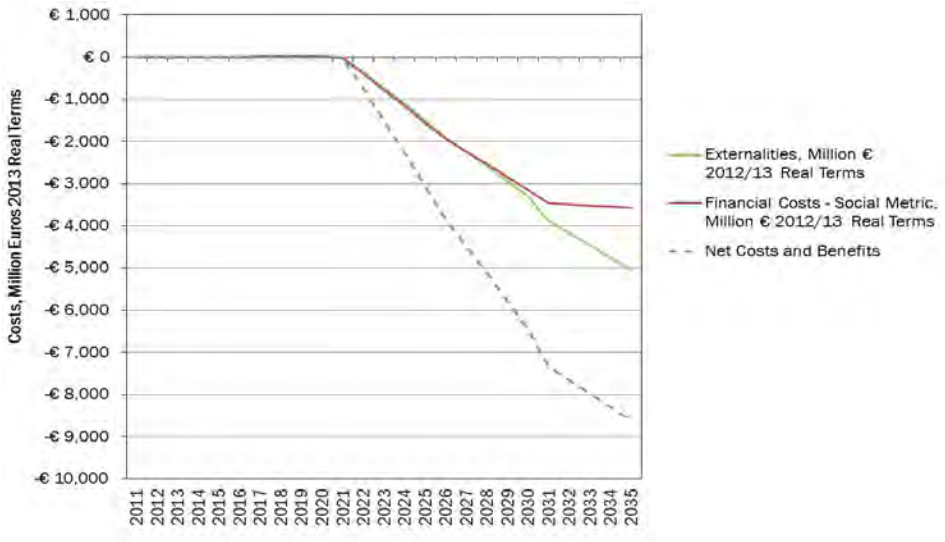

Figure 16: Option 3.1 (high) – Social Costs (M€, relative to full implementation, EU 28)

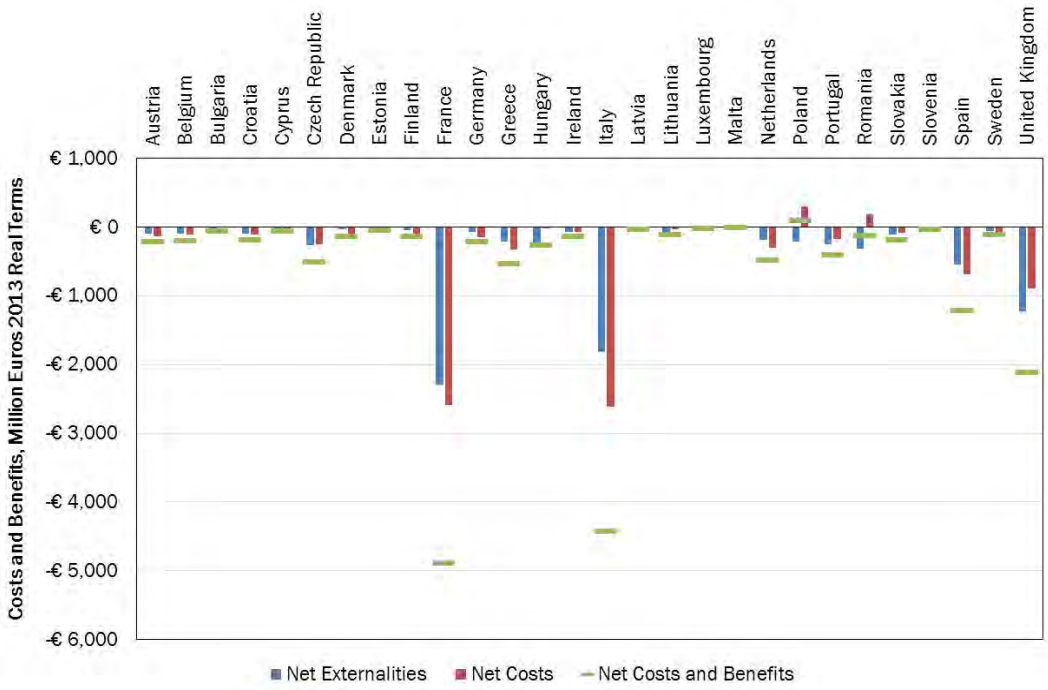

Figure 17: Option 3.1, high – NPV 2014-2030 costs/benefits (M€ to full impl EU 28)

Employment

This Option also leads to an increase in employment. The estimated increase in direct employment is 137,585 FTEs in 2030.

Option 3.2: Increased Packaging targets

Option 4.2 implies a progressive increasing of packaging recycling up to 80%. As part of packaging waste is of municipal origin, this will have an influence on the municipal waste recycling rate (increase by around 10% by 2030. As shown in Figure 18, landfilling is expected to progressively decrease as well as incineration in some MS. Most of the changes will start in 2016 when the possible new targets would be known by MS.

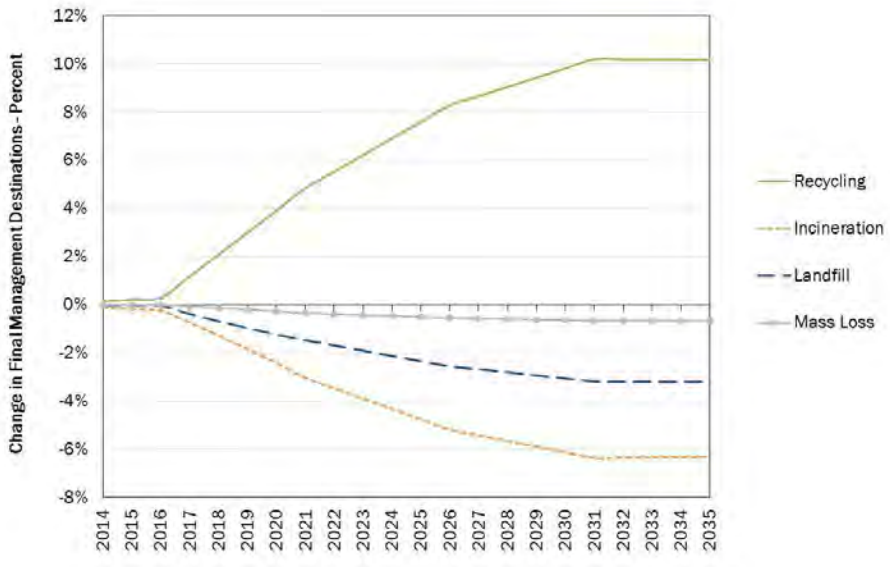

Figure 18: Option 3.2 – Changes in mass flows (% relative to full implementation, EU 28)

Financial Costs

Under this Option, the overall costs for the MS show net benefits very early on. As with previous Options, this is a result of the two competing effects, one from the increase in the cost of recycling, the other from the avoided costs of waste being collected and treated as residual waste. The effects are more pronounced because in Option 3.1 a significant proportion of the waste collected and treated for recycling is biowaste. This entails costs both in collection and treatment, whereas the collection of dry recyclables leads to the capture of material which can generally be sold at a better price.

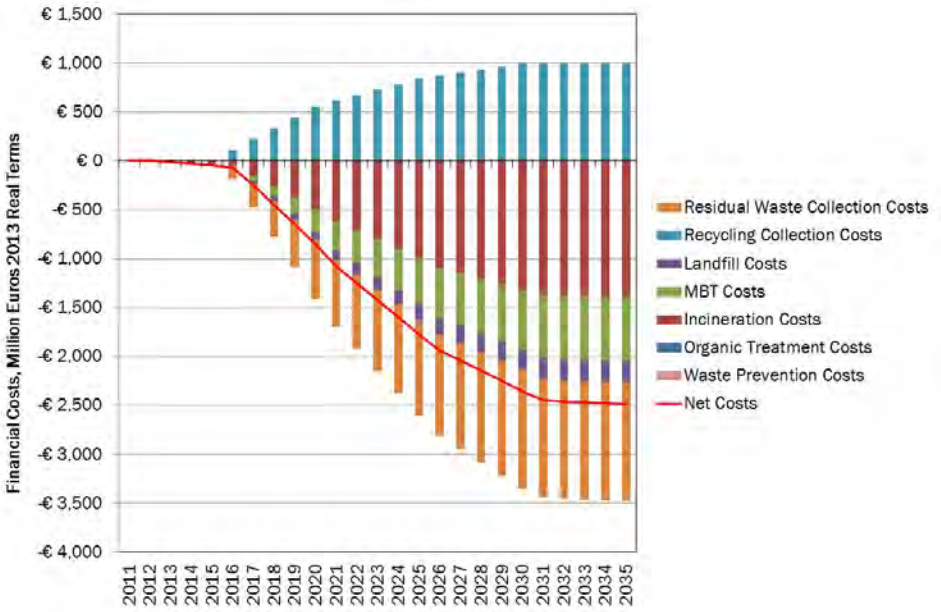

Figure 19: Option 3.2 - Financial Costs (M€ relative to full implementation, EU 28)

Environmental Costs - This Option is associated with significant environmental benefits, primarily due to the reduced reliance on incineration and landfill, both associated with fairly significant environmental impacts (these relate to GHGs and emissions to air, see Annex 6)

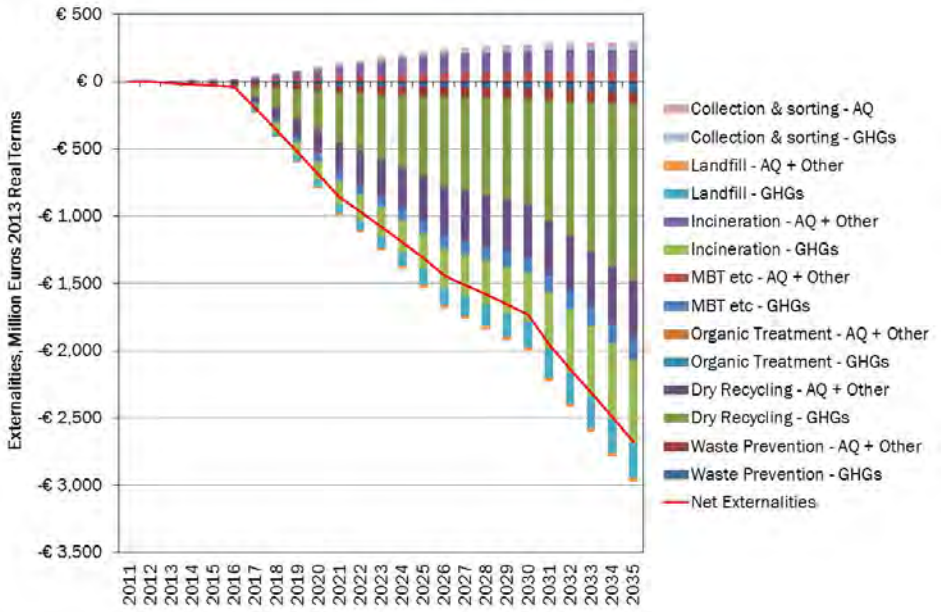

Figure 20: Option 3.2 - Externalities (M€ relative to full implementation, EU 28)

Net Social Costs

When considering the EU28 as a whole the net position of this Option is very favourable and is clearly linked to overall financial and environmental benefits – see Figure 21. On a MS level this Option also yields net social benefits for the vast majority of countries. Figure 21 shows the Net Present Value (2014 – 2030) of the costs and benefits for each MS. It is evident from this that the variance across MSs is quite significant, this is due, at least in part, to the size of the economies and the relative amount of packaging materials that are placed on the market in these countries (e.g. Germany, France, Italy, and the United Kingdom).

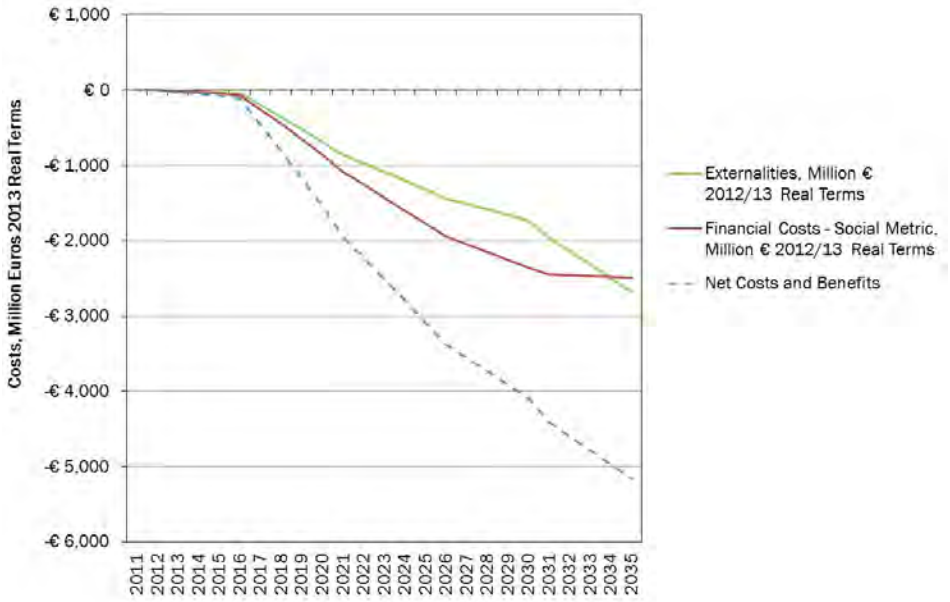

Figure 21: Option 3.2 – Net Social Costs (M€ relative to full implementation, EU 28)

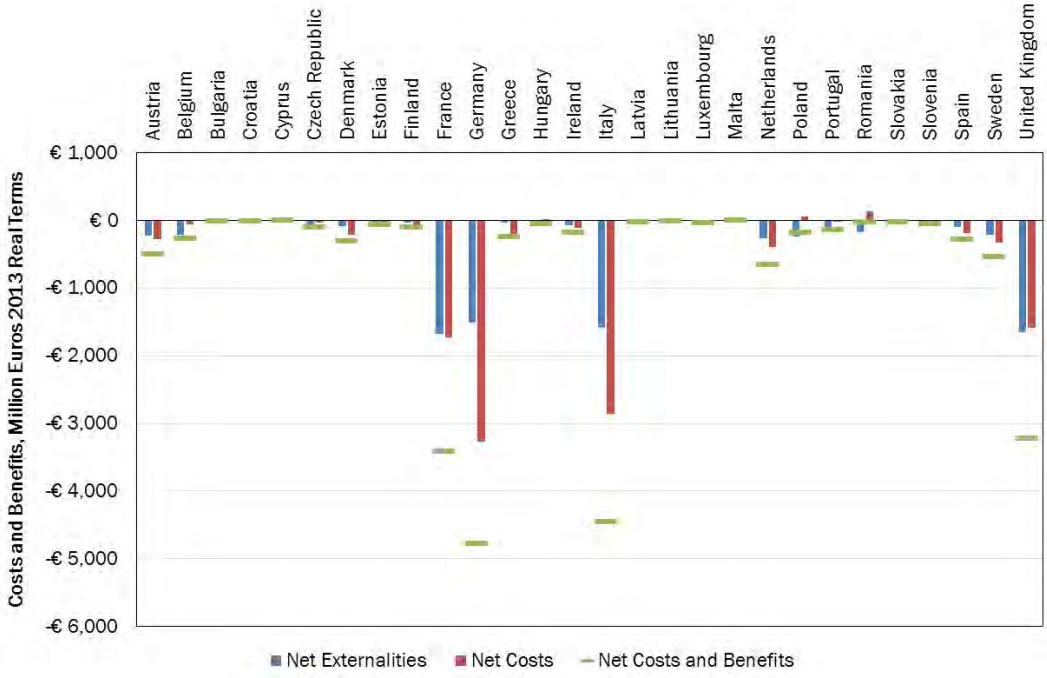

Figure 22: Option 3.2 – NPV 2014-2030 costs/benefits (M€ relative to full implementation)

Employment

Option 3.2 also leads to an increase in employment. The estimated increase in direct employment is 107,725 FTEs.

Option 3.2 – Metal spilt

The split between targets for ferrous and non-ferrous metals is expected to bring additional benefits as more Aluminium will be captured and recycled leading to additional avoided GHG emissions due to the 'energetic content' of Aluminium requiring a lot of energy for its production. The overall difference of NPV (2014-2030 at EU 28 level) between Option 3.2 without metal split and with metal split is estimated at 3,87 billions €.

Option 3.3 Measures to limit landfilling

As detailed in section 4, in this Option, landfilling will be progressively limited to 25% by 2025 for all MS and to 5% by 2030. This Option assumes that a landfill ban is implemented in isolation without additional efforts on recycling – which might not correspond to the reality in all MS. Nevertheless, in absence of clear indication on how MS would react to the introduction of a ban in isolation of additional measures, it was assumed that MS will respond by constructing treatment capacities – mainly incineration capacities see Figure 23 below - to deal with the residual waste remaining after full implementation has been achieved. As for option 3.2, it was assumed that most of the changes will start in 2016 when the possible new targets would be known by MS.

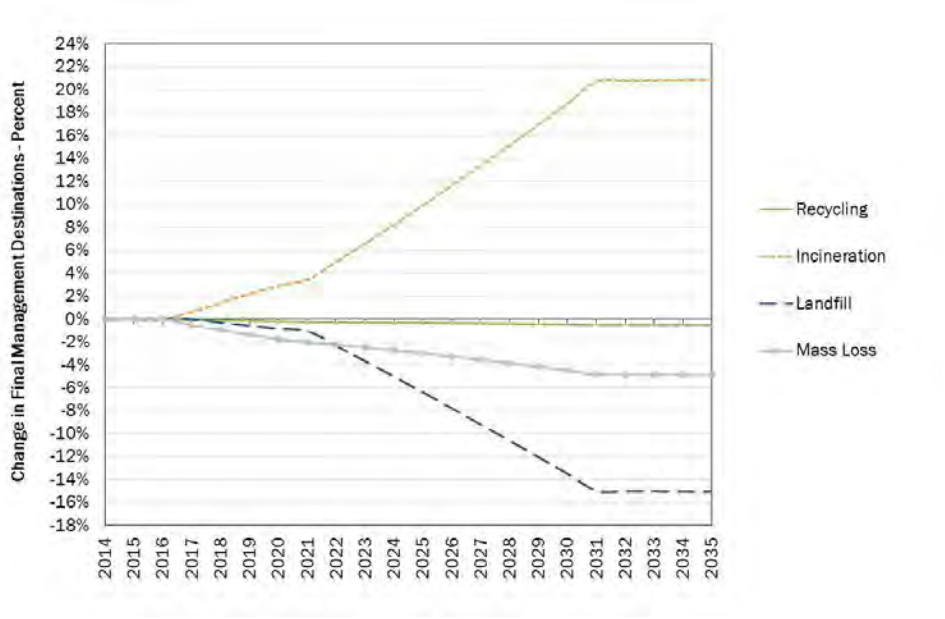

Figure 23: Option 3.3 - Changes in mass flows (%relative to full implementation, EU 28)

Financial Costs

The costs of this upfront investment are clear in the graph below. The increase in costs relates mainly to the fact that, because this is a cost benefit analysis and excludes taxes and transfers from the analysis, the costs of landfilling exclude the effect of instruments such as landfill and incineration taxes, and the support mechanisms in place in some countries for renewable energy. Under these assumptions, the costs of switching from landfill (without tax) to other residual waste management options are relatively high and not least in those countries where landfill clearly remains a very low cost option.

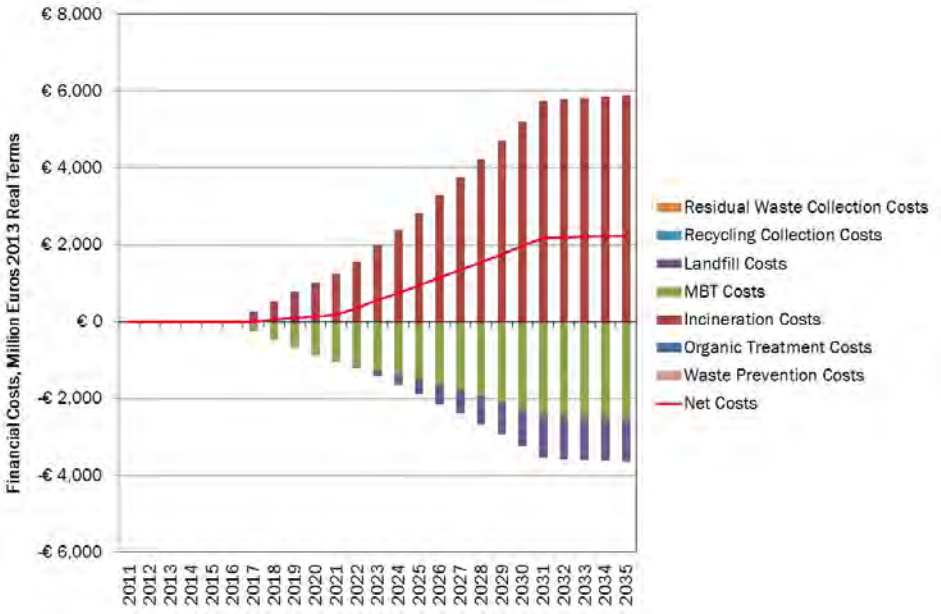

Figure 24: Option 3.3 - Financial Costs (M€ relative to full implementation, EU 28)

Environmental Costs

This scenario is associated with environmental benefits as materials are diverted from landfill and additional energy is produced by burning more waste.

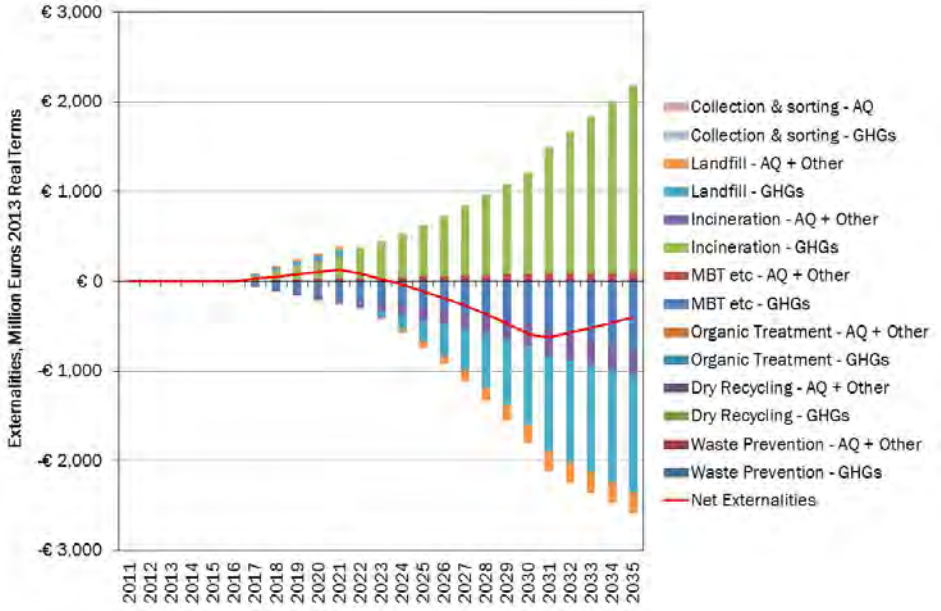

Figure 25: Option 3.3 - Externalities (M€ relative to full implementation, EU 28)

Net Social Costs

The overall position of this Option is that there is a net social cost as MS respond to the ban by constructing residual waste treatment capacity to deal with the residual waste that remains after MS have achieved full implementation of the existing legislation. The slight environmental benefits associated with this change in the early years are clearly outweighed by the costs. Essentially, this implies that the additional costs of switching from landfill to other residual waste treatments exceed the benefits that flow from such a switch.

This is broadly consistent with the majority of other studies on the costs and benefits of landfill and incineration.

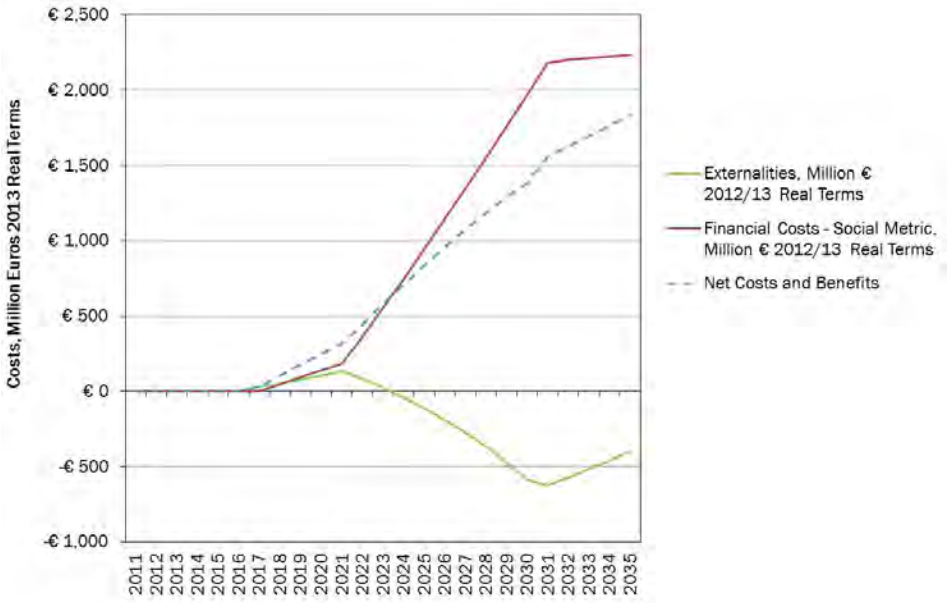

Figure 26: Option 3.3 – Net Social Costs (M€ relative to full implementation, EU 28)

Employment

This Option also leads to an increase in employment. The estimated increase in direct employment is 46,165 FTEs. This reflects the fact that the residual waste treatments are less 'employment intense' than other forms of treatment.

Option 3.4: **Combined option**

On the basis of the above analysis, the following option has been considered for assessment:

1. The MSW targets stretched to 2030; with
2. The increased packaging targets; and
3. The restriction on MSW landfilled (to 5% of total) by 2030.

In the first instance, this combined option has been considered as being applied at the same level for all countries. The landfill restriction has been retained despite the net social costs indicated by the analysis of the impact of a landfill ban in isolation of an increase of recycling targets. The analysis from the modelling does not include all environmental externalities, notably those associated with emissions to water and land, which might be expected to be of some significance for landfilling, possibly in the longer term. The approach is also aligned with the vision set out in the Resource Efficiency Roadmap and 7th EAP.

As shown in Figure 27, this option implies an increase of recycling of 25% compared to the full implementation Scenario.

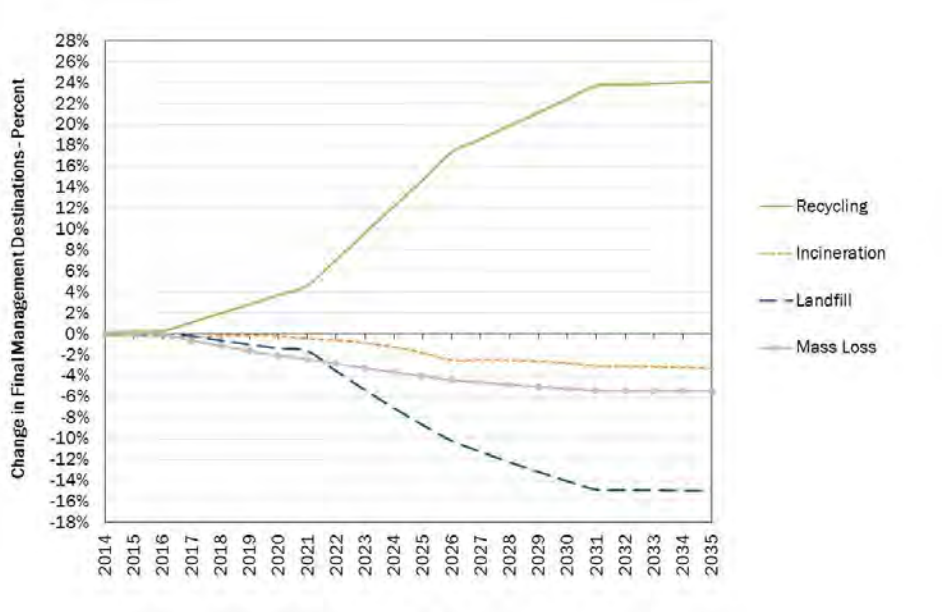

Figure 27: Option 3.4 - Changes in mass flows (% relative to full implementation, EU 28)

The graphics below indicate the financial costs (Figure 28), the environmental costs (Figure 29), and the net social costs of the proposed combination of options (Figure 30 and Figure 31). As stated above all figures are given relative to full implementation.

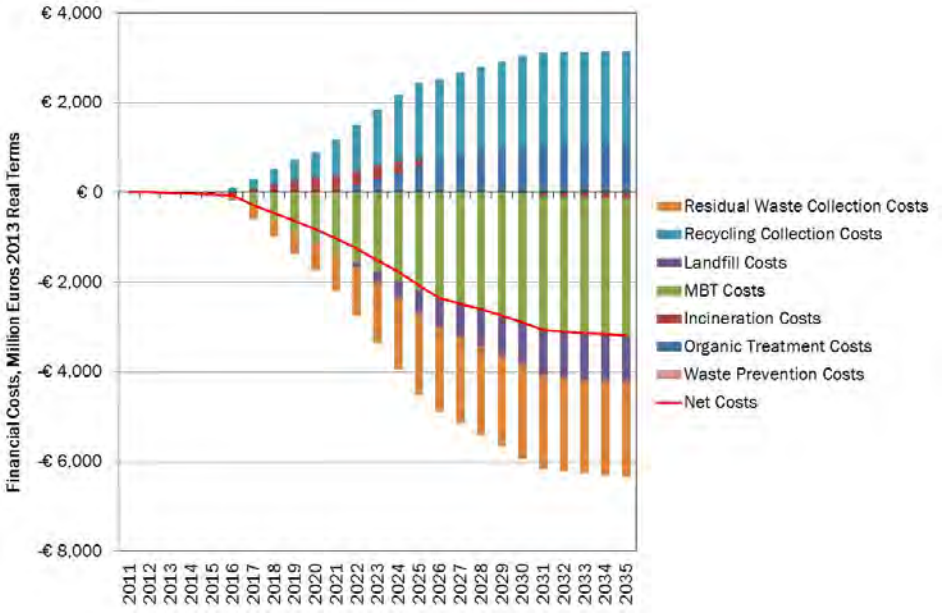

Figure 28: Option 3.4 – Financial Costs (M€ relative to full implementation, EU 28)

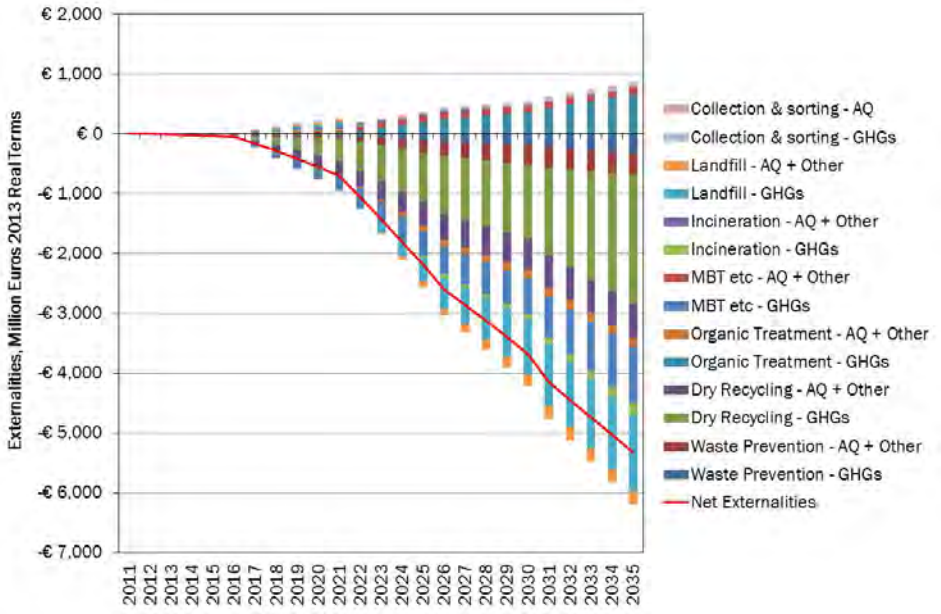

Figure 29: Option 3.4 - Externalities (M€ relative to full implementation, EU 28)

The marine litter modelling demonstrates that the combined effect of Option 3.4 is that projected new marine litter inflows are found to be 27,5% lower than those projected by the full implementation of existing legislation only by 2030. The decrease to 2020 is less pronounced (13%) since most of the measures only enter into force after 2020.

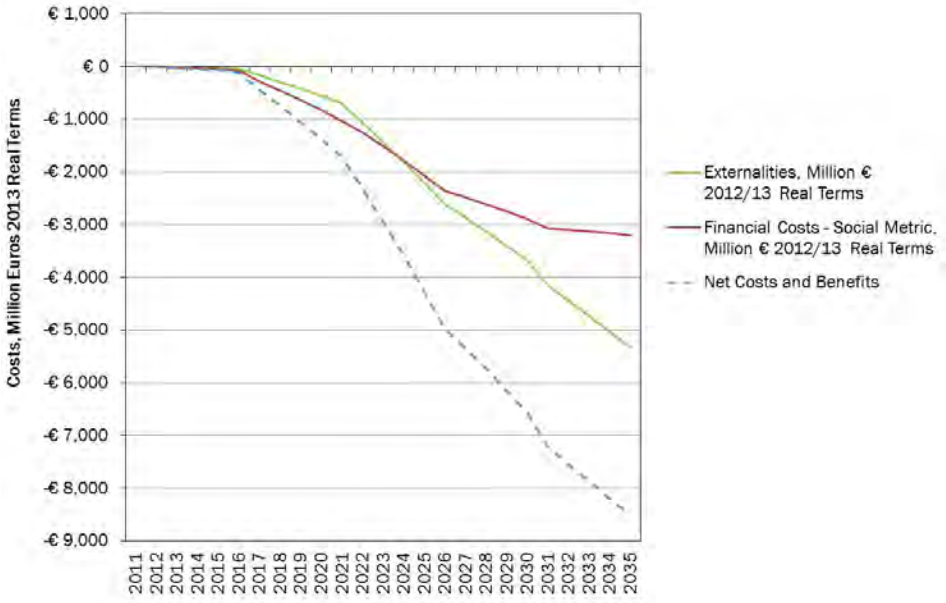

Figure 30: Option 3.4 – Net Social Costs (M€ relative to full implementation, EU 28)

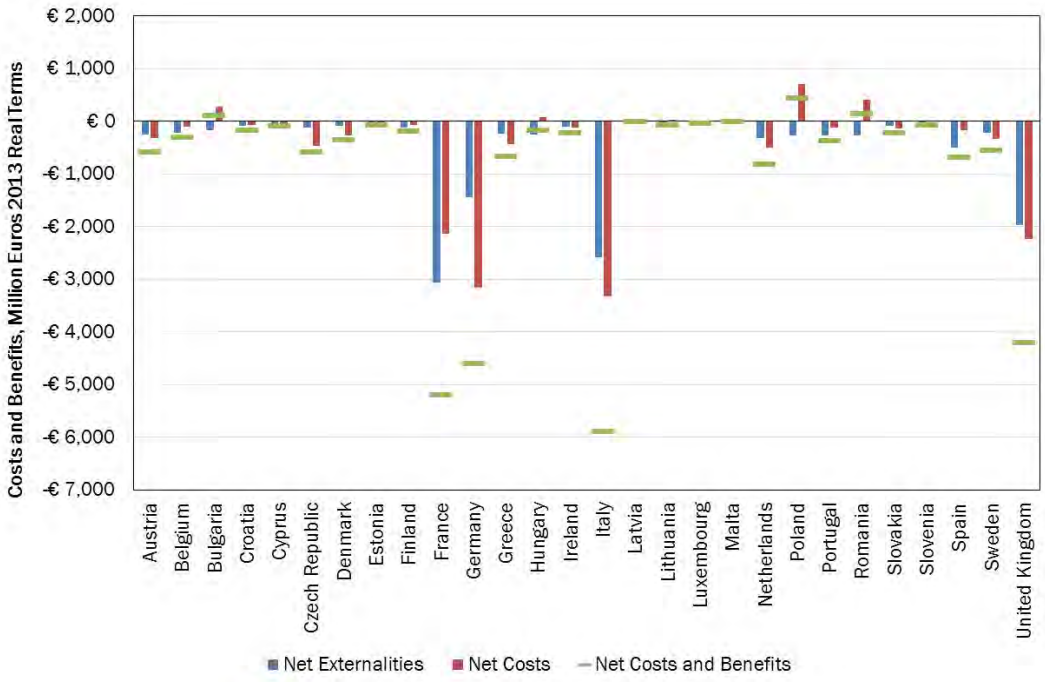

Figure 31: Option 3.4 – NPV 2014-2030 costs/benefits (M€ relative to full implementation)

As detailed in Figure 32, the approach would generate an estimated 177,637 FTEs in terms of employment across the EU.

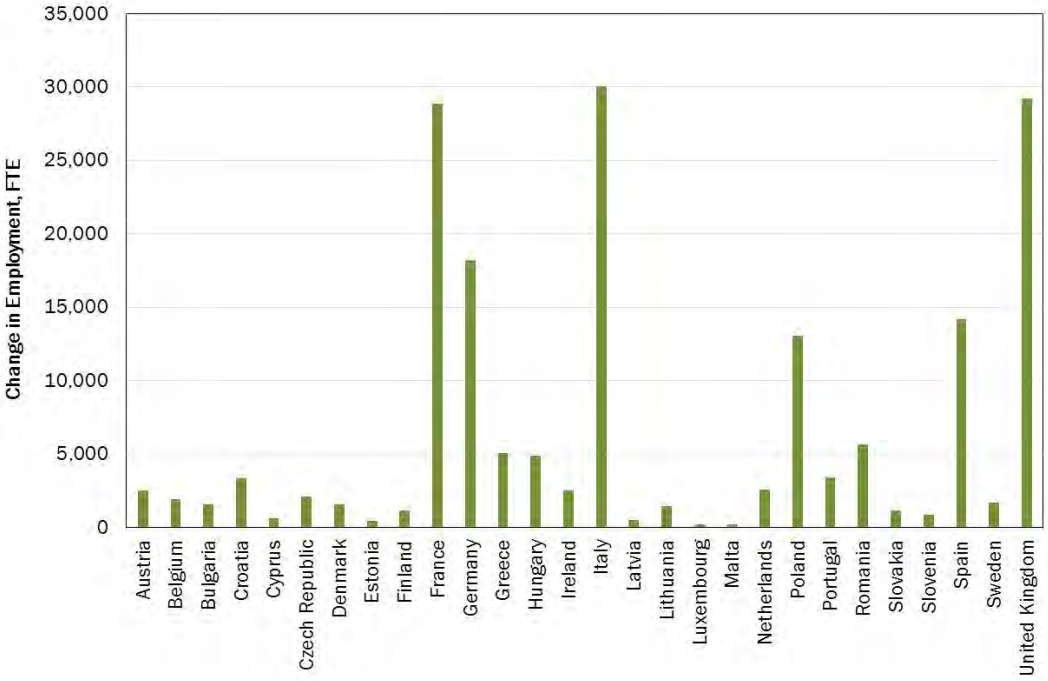

Figure 32: Option 3.4 - Changes in employment by 2030 relative to full implementation

Options 3.5 and 3.6

The impacts of options 3.5 and 3.6 as detailed in Section 4.4 are the same in terms of mass flow changes in the longer term than for option 3.4: imposing more stringent but still realistic deadlines could be achieved thorough differentiated deadlines per Group of MS or with time derogation for some MS according to their actual situation in terms of waste management. The difference between options 3.5 and 3.6 with option 3.4 is more significant for 'Group 2' and less important for 'Group 1' MS.

For Group 1 and 2 MS, the costs and benefits of increased recycling will be captured more rapidly than in option 3.4 which will have an influence on the net present value (NPV) at the EU 28 level: both options 3.5 and 3.6 will lead to an additional NPV of the net benefits of € 27,2 billion compared to the NPV of Option 3.4. Also the creation of jobs will be more rapid for Groups 1 and 2 if options 3.5 and 3.6 are implemented.

Option 3.7- Extension of landfill restrictions to other waste similar to municipal waste

Extending the proposed municipal waste landfill ban to all non-municipal waste landfilled in 'Category 2' landfills (designed to accept municipal waste and similar waste according to the Landfill Directive) would concern around 58 million additional tons of waste (55% increase compared to municipal waste).

In absence of any quality data on the composition of this additional waste and due to the lack of a clear counterfactual in terms of how such wastes might be managed in future, it has been assumed that:

- Such waste have a composition similar to municipal waste;
- Extending the ban to all similar waste would increase recycling in the same proportion than for MSW (70%), as well as a shift in the management of residual waste from landfill to various treatment options.

On this basis, it has been assumed that the present value (NPV 2014-2030, EU 28) of the social costs increased by 3.35 billion € compared to Option 3.4. It should be noted, however, that the different waste compositions will, in reality, affect environmental benefits, whilst the costs may be expected to be different, in reality, than for the municipal wastes.

In practice, extending the proposed ban to all waste entering 'Category 2' landfills will facilitate the enforcement of the proposed ban as it would apply independently from the origin of the waste as long as its composition is similar to municipal waste.

Main uncertainties associated with the model

The modelling which forms the basis for the IA is complex and incorporates a range of assumptions and variables which can be expected to influence the assessment. The main uncertainties are related to the design of collection systems in the MS, collection and treatments costs, waste composition and its evolution, material and energy values over time and GHG damage valuation. A summary of the main uncertainties is provided in Annex 8.

Nevertheless, it should be noted that:

1. The model has been subject to peer review;
2. Considerable efforts have been made to ensure assumptions are reasonable, and the modelling is based on the best information available (20 country visits were achieved to gather the most recent and relevant data);
3. These efforts will be carried on by the EEA as the model will become a permanent tool maintained and improved by the EEA.

Finally, these uncertainties if they might influence the results in absolute terms, they will not change the relative position of the impacts of the different Options assessed in this IA.

1.3. Impacts on groups of stakeholder

Public authorities/ citizens: Meeting the proposed targets will imply in some zones additional direct costs particularly where separate collection have to be launched. These direct costs will be largely compensated by the expected benefits at society level. As shown in section 5.2, direct savings might be expected in the midterm as less residual waste will have

to be collected and treated. These savings should be beneficial for public authorities and for citizens (less waste related taxes).

Nevertheless, experience confirmed by the results of the model (full implementation scenario), shows that direct costs are expected to increase in the first years as it is necessary to launch new ways of collecting waste (separate collection) and new waste treatment infrastructures (sorting centre, composing and digestion facilities, energy recovery infrastructures in the MS landfilling high level of waste). These costs have to be partly covered by public authorities in charge of waste management.

There are several ways of limiting he direct costs for the public authorities linked with improved waste management techniques:

- Focusing on the prevention of waste through fostering heightened awareness of the issue, and collaborating with private sector companies to design waste out of systems, or make the wastes more easily re-useable / recyclable; Citizens can be beneficiaries of waste prevention: for example, initiatives which have highlighted the level of waste of food have also brought to the attention of citizens the simple truth that wasting food wastes money;
- Improving governance - ensuring a better coordination between the authorities in charge of collecting and treating can lead to an integrated approach of waste management and a reduction of the costs;
- Focusing on efficiency of service delivery – the evidence suggests that there are further gains to be made in terms of improving the design of collection services and in ensuring citizens are able to participate easily in the system;
- Midterm targets – fixing at EU level a clear perspective at a mid-term horizon will avoid inappropriate investments which at the end are often paid by the local authorities;
- EPR schemes – have proven to having helped to cover the costs for launching separate collection – as detailed above, there is still large possibilities of optimizing these EPR schemes while expanding them to other waste streams;
- PAYT systems – the application of ‘clever’ PAYT systems are very effective to favour prevention and the participation in separate collection schemes, which in turn limit/reduce the overall costs of waste management.

As detailed in section 4.3, an optimal combination of economic instrument can contribute to improve waste management while limiting the overall cost of the system. In that sense, ensuring the dissemination of best practice is essential particularly in those MS where additional efforts will be needed to meet the proposed targets – which is one of the objectives of the proposed ‘early warning procedure’.

Manufacturing industries should be benefit from the re-injection in the EU economy of secondary raw materials (limiting the risk of raw material prices increase). In addition, it has been demonstrated that EPR schemes could be optimised notably through EU harmonisation which in turns could limit the fees to be paid by the producers/importers when they pace goods on the EU market. In the midterm, the manufacturing industry might also have to progressively modify the design of the products in order to ease the achievement of the European targets.

Waste operators whether **large companies or SME** involved in waste collection and treatment should benefit from better implementation of existing legislation and from new targets. As highlighted during the stakeholder consultation, new business opportunities will be

created whether in collection, sorting or treatment sectors. The main potential loser might be landfill and low performing MBT operators but this should be limited as most of them are part of larger waste management group already having diversified their activities. Similarly in a limited number of countries few incinerator operators might meet difficulties to feed their oversized infrastructures. This might be attenuated by imports from MS lacking incineration infrastructures. **The recycling industry:** Reinforcing the target will create new opportunities and push for more innovation notably in sorting and recycling techniques. **Social enterprises** active in waste re-use could also benefit from additional stimulus to favour reuse for instance in the second hand sector.

Improved waste management might impact **SMEs** as additional efforts might be required to ensure proper at source waste separation. At the same time increasing prevention, reuse and recycling might also reduce the costs of waste management. SMEs flexibility, adaptability, and their willingness and ability to innovate also represent an asset for instance for the development of new techniques for improving waste sorting, reuse and recycling. The SME sector is a large part of the waste industry and some SMEs will be beneficiaries of a more forward thinking vision for waste management. As suggested during the seminar with SME's held in preparation of this IA, some simplification measures should be envisaged for SME's handling small quantities of waste.

The tourism and the fishery sectors would also benefit from reduced marine litter.

2. COMPARING THE OPTIONS

In this section, the impacts of the options are compared between them. First the Options are compared on the basis of quantified data when they are availbale (costs and benefits, impacts on employment and contribution to marine litter reduction). Then, a qualitative comparison of the options is achieved by assessing their relative contribution to each objective identified under section 3. From this combined analysis, a prefered option is then identifed and proposed.

2.1. Costs, benefits, employment and marine litter

The following Graphic shows the net social costs of each option compared to the full implementation scenario.

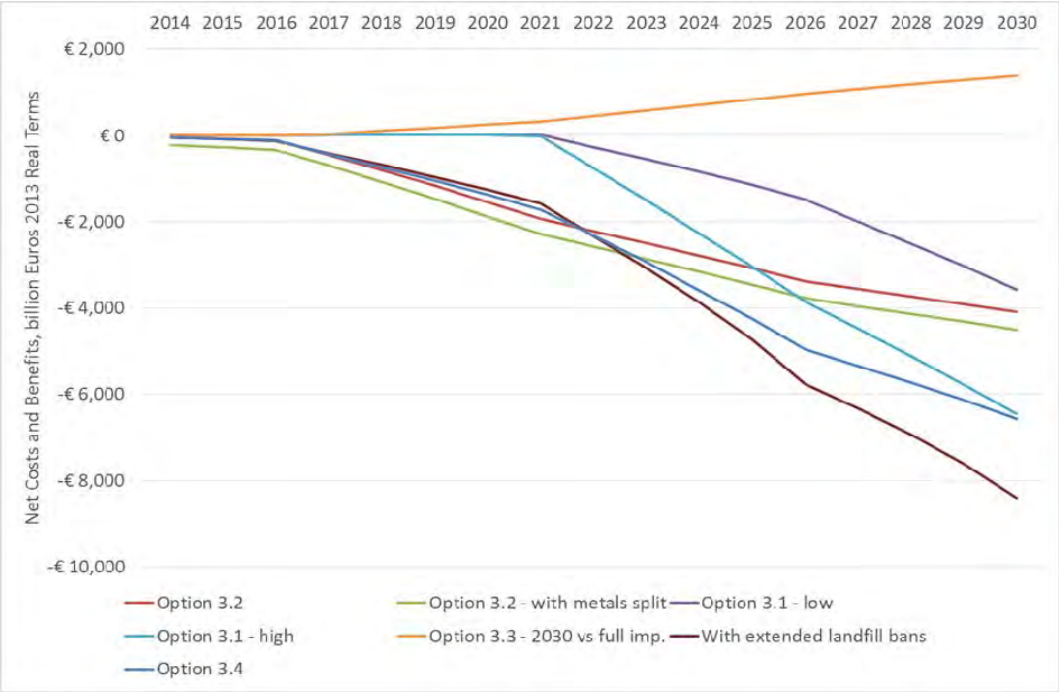

Figure 33: Comparing the options – Net social Costs (billions €, EU 28)

Option 3.4 with an extended landfill ban to all waste similar to municipal waste provides the highest ratio Cost/Benefits and represents the most interesting Option at society level.

The impacts from 2014 to 2030 of each option for key indicators is summarised in Table 2 below. The greatest net benefit on the period 2014-2030 is delivered by Option 3.7. In terms of job creation, Options 3.4, 3.5, 3.6 and 3.7 are the most promising. Options 3.4 and 3.7 delivers the best result in terms of GHG emission reduction (- 44 million Tons of annual GHG equivalent emission in 2030 and -62 million tons with an extension of the landfill ban to all similar waste).

With the implementation of the Options 3.4 to 3.7 and compared to the full implementation scenario, marine litter could be reduced by an additional 13% by 2020 and by an additional 27,5% by 2030.[16] Additional savings coming from reduced marine litter inflows, by 2030 under these Options are estimated at 143 m€, mainly as a result of reduced beach cleaning and avoided damage to fishing vessels and gear (see Annex 9).

[16] This is compared to a 12,3% increase to 2030 under the BAU scenario, knowing that it does not take into account the reduction potential of up 80% in the consumption of single-use plastic bags identified in the IA accompanying the recent related Commission proposal

Option	Financial costs (NPV 2014-2030), € billion (1)	External costs (NPV 2014-2030) € billion (2)	Net social costs (1+2)	Jobs (FTEs in 2030)	GHG million tonnes $CO2_{eq}$ (2030)	GHG million tonnes $CO2_{eq}$ (2014-2030)
Option 3.1- low	-3.73	-3.96	-7.69	78,519	-23	-107
Option 3.1- high	-8.41	-8.49	-16.91	137,585	-39	-214
Option 3.2	-11.2	-8.45	-19.66	107,725	-20	-183
Option 3.2 – metal split	-13.48	-10.05	-23.53	107,643	-24	-250
Option 3.3	5.64	-0.65	4.99	46,165	-13	-49
Option 3.4	-12.65	-13	-25.65	177,637	-44	-308
Option 3.5 and 3.6	-13.62	-13.58	-27.2	177,628	-44	-320
Option 3.7	-10.7	-18.3	-29		-62	-443

Note, negative costs represent a benefit

Table 2: Comparison of key indicators of the options retained

2.2. Contribution to the main objectives, efficiency and coherence

In Table 13 below, the relative contribution of each option to the main objectives as identified in section 3 is summarised.

With **Option 1 –** Full implementation, the legislation will remain complex and difficult to enforce properly, there will be no guarantee that best practices will be disseminated especially in the MS facing poor waste management performances, the level of the targets will remain too low to build a 'circular economy'.

All the other Options are compared to Option 1 as they come on top of full implementation of the existing legislation.

Option 2 scores best in terms of meeting some of the key objectives of this IA: several measures are proposed to simplify the legislation (dramatic reduction of reporting obligation, simplification of the measurement methods, removing obsolete requirements, reduction of administrative burden for SME's, etc). Monitoring will be improved with the proposed measures to increase the reliability of statistics and with the new early warning procedure. Best practice will be disseminated with the implementation of the early warning procedure. Nevertheless, without new upgraded targets the contribution of Option 2 taken in isolation to resource efficiency will remain limited.

This option contributes to several objectives as defined in section 3 (see Table below) while some net savings could be expected (simplified reporting which should compensate efforts required on statistics – see section 5.2). In that sense, Option 2 can be seen as relatively efficient. Nevertheless, this Option is less coherent with some overarching objectives of the EU polices (resource efficiency, climate change, raw material access) than the other options including higher targets even tough it will contribute to a better implementation of the EU legislation which is also one of the overarching objectives of the EU.

Compared to the full implementation scenario (Option 1), **Options 3.1** has limited advantages in terms of simplification and monitoring (one measurement method). The contribution to resource efficiency of Option 3.1 is positive (higher for Option 3.1 – high) and meeting the proposed targets implies that best practices are disseminated.

Compared to the full implementation scenario (Option 1), **Options 3.2** has limited advantages in terms of simplification and monitoring (removing obsolete requirements and targets). The contribution to resource efficiency of Option 3.2 is positive and meeting the proposed targets implies that best practices are disseminated notably in terms of improved EPR schemes.

Options 3.3 has limited advantages in terms of simplification and monitoring (replacement of the landfill diversion target for biodegradable waste by overall landfill bans) compared to the full implementation scenario (Option 1), The contribution to resource efficiency of Option 3.3 is positive but limited as part of the waste diverted from landfilling will be incinerated including waste that could have been recycled. Meeting the proposed targets implies that best practices are disseminated notably in terms of use of key instruments (landfill taxes followed by landfill bans).

Option 3.4 has more advantages in terms of simplification as the proposed targets are consistent and synergetic between them. The proposed deadlines for each target are consistent between them as well as the level of the proposed targets. This simplification will facilitate the monitoring of the targets and meeting high levels of recycling while reducing landfilling will require the dissemination of best practices in all MS. The contribution to resource efficiency is considered as positive compered to –the full implementation scenario.

Compared to Option 3.4, options 3.5 and 3.6 are less performing in terms of simplification and monitoring as fixing differentiated targets depending on MS and/or allowing for time derogation will not contribute to simplify the legislation and the monitoring of the targets. The contribution to resource efficiency is nevertheless higher mainly because more raw materials and resources are captured earlier in several MS.

Option 3.7 performs better in terms of simplification and monitoring (landfill restrictions are applied to all ‘municipal’ type landfills independently from the municipal origin of the waste).

Options 3.4 to 3.7 have the most positive impact in terms of reductions of marine litter. However, a significant portion of the gains made are as a result of avoided increases in litter, rather than actual reductions of current litter inflows. Therefore further action is needed to achieve the significant reductions in marine litter called for in the 7th Environment Action Programme.

All Options between 3.1 and 3.7 will contribute to the objectives as defined in section 3, Option 3.3 being the less cost effective (and therefore the less efficient) though Option 3.7 has the best cost/benefit ratio while contributing highly to all objectives. The other Options are more of less efficient depending on their contribution to the objectives compared to their costs and benefits – see Table 3. As shown in Table 2, the coherence with some overarching objectives of the EU polices (resource efficiency, climate change, raw material access, job creation) is highest for Option 3.7 and lowest for Option 3.3 with intermediate situation for the other Options.

	Objective 1 - Simplify	Objective 2 - Improving Monitoring	Objective 3 - Best practices	Objective 4 – Resource efficiency	Efficiency	Coherence
Option 1	**0**	**0**	**0**	**0**	**0**	**0**
Option 2	**+ + +**	**+ + +**	**+ +**	**+**	**++**	**+**
Option 3						
Option 3.1 - low	**+**	**+**	**+ +**	**+**	**+**	**+**
Option 3.1 - high	**+**	**+**	**+ + +**	**+ +**	**+ +**	**+ +**
Option 3.2	**+**	**+**	**+ +**	**+ +**	**+ +**	**+ +**
Option 3.3	**+**	**+**	**+ +**	**+**	**-**	**+**
Option 3.4	**+ + +**	**+ +**	**+ + +**	**+ +**	**+ +**	**+ + +**
Option 3.5	**+ +**	**+ +**	**+ + +**	**+ + +**	**+ +**	**+ + +**
Option 3.6	**+ +**	**+ +**	**+ + +**	**+ + +**	**+ +**	**+ + +**
Option 3.7	**+ + +**	**+ + +**	**+ + +**	**+ + +**	**+ + +**	**+ + +**

Table 3: Comparison of the effectiveness, coherence and efficiency of the options

2.3. Preferred Option

From the above analysis, it could be concluded that:

Option 2 would be useful to support the implementation of existing targets but seems indispensable if the proposed new targets arte applied. The measures proposed in Option 2 contribute to several objectives defined in section 3 and could be seen as 'accompanying measures' to ensure a proper implementation of the targets. Nevertheless, Option 2 taken in isolation will not deliver the expected results in terms of resource efficiency.

Options 3.1, 3.2 and 3.3 taken in isolation will not deliver the best results in terms of consistency between the proposed targets and cost and benefit ratio. As explained above, **Options combining the different targets (**Options 3.4 to Option 3.7**)** seems to be the most attractive. These options give a **consistent perspective** to waste management in the EU on the basis of past experience of the most advanced MS: **landfill restrictions are progressively introduced** and **at the same time recycling targets are progressively increased** which should avoid the creation of overcapacities of residual waste treatment facilities.

The proposed rate of progression of the recycling/reuse rates for municipal waste are fully consistent with the proposed packaging rates and with the progressive diminishing of landfilling: MS will progressively increase their packaging recycling/reuse rates which will contribute to increase the municipal recycling/reuse rates and at the same time reduce landfilling of municipal waste. By 2030, with the proposed approach a maximum of 30% of municipal waste will not be recycled or reused. This residual waste will be treated in residual waste facilities (incineration with energy recovery, MBT, others) so that only 5% corresponding to the not recoverable fraction will be at the end landfilled. This fully consistent approach for target setting was a repeated demand from the majority of the stakeholders.

Between Options 3.5 and 3.6 there is **no clear preferences**: fixing more stringent deadlines for some MS as proposed in these options allows capturing the potential benefits linked with improved waste management earlier (higher NPV). At the same time, fixing different

deadlines complicates slightly the legislation even if it is already the case for some waste related Directives for which the deadline diverges according to the MS. Option 3.5 and 3.6 have pro and cons in terms of acceptability by the MS depending on the position of the MS. Fixing the same deadlines for all MS in a realistic way implies that the less performing MS are driving the ambition level of the EU legislation.

Nevertheless, these targets are minimum targets, nothing prevents MS from meeting more ambitious levels and/or more rapidly than the deadlines fixed in the legislation.

Option 3.7 expanding the landfill ban to all waste similar to municipal waste is the most attractive in terms of simplification, monitoring, best practice dissemination, resource efficiency, but also in terms of Cost/benefit ratio, job creation and GHG emission reduction.

This Option is similar to the main orientations provided by the Committee of the Regions[17] in its outlook opinion on the target review – see **Error! Reference source not found.** and is conform to the orientations of the 7th EAP which were recently endorsed by the Parliament and the Council.

A combination of Options 2 and 3.7 is therefore proposed.

2.4. Key implementation challenges

The main challenges related to the implementation of the proposed targets could be summarised as follows (more details per stakeholder group are given in section 5.3):

- For the less advanced MS, additional efforts will be required to develop separate collection at source, build the required infrastructure, adapt the waste management plans and strategies, and improve governance notably by ensuring a better coordination between the local, regional and National levels.

  Measures proposed to disseminate best practices notably through the 'early warning' procedure, the dissemination of economic instruments, proposed improvements of EPR schemes (minimum requirements and guidance to MS) should ensure that these MS are taking advantage of the experience of the other MS to design the appropriate package of measures to meet the targets and at the end capturing rapidly the potential savings linked with the implementation of the upgraded targets.

  Enough time was given to these MS to progressively meet the proposed targets (around 15 years calculated on the basis of the past experience of the other MS). In addition, as explained in section 4, all the proposed targets are already met today in some MS which demonstrates that they are perfectly feasible from the technical-economic point of view. In addition, new techniques have emerged at all levels of the recycling chain (separate collection, sorting, recycling) which should allow less advanced MS to make rapid progress in the coming years.

  With the proposed targets, a clear and robust perspective is provided allowing the development of long term investment strategies. This will also provide clear lines for the future use of structural funds which should be orientated on the first steps of the waste hierarchy in line with the proposed targets. These funds could help to accelerate the necessary changes even though the recent experience of some MS (notably Estonia – see Box 2) has shown that an appropriate use of economic instruments can deliver the expected results without using these funds.

- For few more advanced MS, some difficulties might appear when overcapacities of incineration have been constructed. These temporary difficulties could be addressed by

[17] This Committee represents local and regional authorities which are in first line for what concerns municipal waste management

increasing imports of waste from surrounding countries lacking of infrastructure and not replacing the oldest or less performing facilities notably in terms of energy recovery. These changes have already started as explained in section 2.5.2.

The experience of the most advanced MS shows that meeting upgraded targets will not be possible without a better use of key instruments, an improved organisation and coordination of the competent authorities as well as the involvement of the whole civil society from citizen, NGO's to industry and public authorities. In that sense, the proposed targets might be considered as a key driver to ensure that enough efforts will be achieved by all MS to address the causes of the problem identified in this impact assessment (such as issues related to governance, lack of use of economic instruments, lack of public awareness, inappropriate investments - see section 2.5).

The proposed "early warning" procedure will ensure that MS not making enough progress towards the upgraded targets will be identified sufficiently well in advance so that correcting measures (such as increased use of key instruments and improved governance – see section 4.2) could be taken on time.

Key compliance challenges of the proposed targets are mainly related to the delivery of timely and reliable waste generation and management statistics. This is a permanent concern of the Commission which was also highlighted unanimously by the stakeholder: without reliable data it is impossible to verify whether the targets are met or not. Obviously perfect statistics do not exist but with the proposed measures (development of additional guidance, establishment of national waste registries, third party verification of key statistics, reinforced role of Eurostat, clarification and simplification of the measurement methods) the necessary data should be collected with a satisfactory level of reliability. No new targets are proposed; simply the existing targets are upgraded and simplified/clarified and some obsolete targets are repealed.

In few member States illegal landfilling still exists and pauses clear problems of implementation. It is the responsibility of the Member States to combat illegal landfilling by all means. From that point of view, the proposed revised targets will not change the current situation – combatting illegal landfilling is a pre requisite to meet the existing targets while respecting the existing EU legislation (the Landfill Directive). From that point of view, no additional impacts are expected from the introduction of the proposed upgraded targets compared to the current situation.

2.5. Access to raw materials

As shown in Table 4 below, model calculations estimate that from 2030 onwards more than 50 million tonnes of the four key dry recyclables recovered from the municipal waste stream may be available for processing in the EU under Option 3.7 relative to what was recycled in 2011. This represents a more than doubling of what was recycled in 2011. Compared to the EU consumption of raw material, the expected recycled percentages in 2030 would vary from 3% (metals) to 43% for paper and cardboard, reflecting the relative consumption of the specific materials in consumer applications. This represents an increased value of around 7,2 billion € compared to what was recycled in 2011.

(Thousands of tons)	Recycling 2011	Recycling 2030 – Option 3.7	EU consumption 2011	% recycled in 2030 / EU consumption
Paper/cardboard	26,460	54,431	126,649	43%
Plastics	8,595	20,093	146,256	14%
Metals	6,562	10,799	315,174	3%
Glass	12,601	18,449	95,516	20%

Table 4: Additional recycled material with the proposed option

As explained in section 5.1.1, recognising that raw material costs are one the largest share of input costs of the European manufacturing companies (between 30 and 40% of the cost structures), increasing the availability of high quality secondary raw materials for the EU market will have a positive impact on raw material prices. For several reasons, detailed in section 2.2 and 5.1.1, it is not possible to make solid projections on this potential impact.

The implementation of the proposed package of measures will also have a **direct effect on other waste stream management**: for instance, using economic instruments for C/D waste and municipal/packaging waste such as improved EPR systems or landfill/incineration taxes or PAYT systems will incentivize all initiatives aiming at reducing, reusing and recycling all type of waste. These positive effects can support the implementation of all waste related Directives including Directives targeting waste streams including critical raw materials (WEEE and end of life vehicle).

As shown in the following table, meeting all existing targets is more significant in terms of raw material access. It has been estimated that more than 400 million tons could be re-injected in the EU economy if all EU existing targets are implemented, representing between 10 to 43% of the EU demand depending on the material.

(Thousands of tons)	C/D waste	Recycling 2030 – Option 3.7	WEEE/ELV's	EU consumption 2011	% recycled in 2030 / EU consumption
Paper/cardboard		54,431		126,649	43%
Plastics	7,842	20,093	1,279	146,256	20%
Metals	15,684	10,799	5,865	315,174	10%
Glass		18,449	169	95,516	20%
Aggregates	329,376			1568,457	21%

Table 5: Amount of recycled materials – EU existing + proposed targets[18]

2.6. Conclusions

Compared to the full implementation scenario, this combination of Options 2 and 3.7 will bring several benefits in terms of:

[18] Source : reference 24 in **Error! Reference source not found.**

- Administrative burden reduction in particular for SMEs, simplification and better implementation including by keeping targets 'fits for purpose'
- Job creation – more than 180.000 direct jobs could be created by 2030, most of them impossible to delocalize outside the EU
- GHG emission reduction – around 443 millions of tons of GHG could be avoided between 2014 and 2030
- Positive effects on the competitiveness of the EU waste management and recycling sectors as well as on the EU the manufacturing sector (better EPR, reduced risk on raw material access)
- Marine litter levels 13% lower by 2020 and by 27,5% lower by 2030
- Reinjection into the EU economy of secondary raw materials which in turn will reduce the dependency of the EU on raw materials imports

These midterm targets will give a very clear signal to the MS, the municipalities, the private waste management operators so that some mistakes made in the most advanced MS – creation of over capacities of incineration – would be avoided. It will also drive investments to the first steps of the waste hierarchy and prevent the development of infrastructures leading to high level of residues such as MBT facilities based on mixed waste.

A set of accompanying measures will allow facing most of the implementation challenges related to the proposed upgraded targets.

3. MONITORING AND EVALUATION

The indicators for measuring progress accomplished by MS to meet the key objectives are driven by the legislation itself whether through the application of the waste hierarchy or by the quantitative targets themselves. Key indicators to monitor the achievement of the objectives are summarised in Table 6 below. Most statistics related to waste generation and treatment are already collected by the MS and sent to the Commission (Eurostat/DG ENV). As explained, no new targets are proposed; the existing targets for which monitoring tools are already in place are simply upgraded or clarified.

Indicator	Description, purpose	Who will collect/generate the indicator
Waste generation	Data on overall waste generation and per waste stream – comprising at least municipal, packaging, C/D waste are indispensable notably to follow progress of prevention	MS are already collecting these data and transmitting them to Eurostat
Prevention	As proposed in section 4, a specific new indicator might be calculated from existing data linking waste generation and GDP or consumption. This will give an indication on the effectiveness of prevention policies	Building upon EEA indicators under development, Eurostat databases and EEA reviews of waste prevention programmes
Waste treatment	Data on overall waste treatment and per waste stream – comprising at least municipal, packaging, C/D waste are indispensable notably to follow progress on targets	Eurostat - MS are already collecting these data based on existing legislation and gentlemen's agreement

Distance to target	Distance between most recent statistics/projected data and quantitative legal targets should be regularly generated to monitor MS progress towards the targets and take correcting measures if needed. Concerned targets are: recycling/reuse rates for packaging/municipal waste, material recovery rate including backfilling for C/D waste, landfill diversion targets	MS are already reporting every 3 years on target attainment. As proposed in section 4, Eurostat should become the only recipient of all statistic even target related The EEA should generate regular projections
New possible indicators	Tonnages of various type of materials lost for the EU economy, % of recycled materials re-injected into the EU economy, technical and economic viable potentials for recovering resources from waste in a circular economy	EEA

Table 6: Summary of the main indicators to be used for monitoring progress

A regular - every 3 years- follow-up of the distance to target as they appear in the latest available statistics and from projected data will be set in place notably in the context of the 'early warning' procedure. As explained in section 4, this task might be accomplished by the EEA notably by using the reference modelling tool. Other type of indicators might be generated in the future such as the potential tonnage of waste lost for the EU economy each year, the integration of secondary raw materials into products et on the market, etc. It is also the in the EEA intention to regularly update its ex post evaluation of MS performances on municipal waste, so that progress achieved can be followed for all MS. [19]

[19] See Reference 7 in **Error! Reference source not found.**

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PART 3/6

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Proposal for a Directive of the European Parliament and of the Council

amending Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, 1999/31/EC on the landfill of waste, 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment

{COM(2014) 397 final}
{SWD(2014) 208 final}
{SWD(2014) 209 final}
{SWD(2014) 210 final}

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ANNEX 1: LIST OF ACRONYMS AND ABBREVIATIONS & GLOSSARY

7th EAP - 7th Environment Action Program

Backfilling means a recovery operation where suitable waste is used for reclamation purposes in excavated areas or for engineering purposes in landscaping and where the waste is a substitute for non-waste materials

BAU – Business as usual

C&D waste – Construction and demolition waste, which includes concrete, bricks, gypsum, wood, glass, metals, plastic, solvents, asbestos and excavated soil arising from activities such as the construction of buildings and civil infrastructure, total or partial demolition of buildings and civil infrastructure, road planning and maintenance

EEA - The European Environment Agency

ETC/SCP - European Topic Centre on Sustainable Consumption and Production

Energy recovery – The use of waste as fuel or other means to generate energy. Directive 2008/98/EC introduced specific new criteria to determine the efficiency level at which incineration in municipal waste incinerators can be deemed an energy recovery rather than disposal activity

EPR - Extended Producer Responsibility – these systems makes those placing goods on the market – producers, importers - responsible for the waste collection and treatment of the waste generated

EU-15 – EU Member States having joined the Union before 2004.

EU27 – All EU Member States except Croatia.

FTE – Full time equivalent

GDP - Gross Domestic Product

IA - Impact Assessment

IASG - Impact Assessment Steering Group

Industrial waste – Industrial waste is waste generated in industrial and manufacturing processes such as basic metals, food, beverage and tobacco products, wood and wood products and paper and paper products

LCA – Life cycle assessment (or analysis) – the investigation and evaluation of the environmental impacts of a given product or service caused or necessitated by its existence

MBT – Mechanical Biological Treatment facilities – facilities combining different mechanical and biological treatment usually aiming at treating residual waste (after separate collection)

MS – Member State

MSW - Municipal solid waste – Article 2 of Directive 1999/31/EC defines municipal waste as waste from households, as well as other waste which, because of its nature or composition, is similar to waste from households

MSFD – Marine Strategy Framework Directive (2008/56/EC)

NPP – National prevention programmes – Article 29 of the WFD requires MS to prepare waste prevention programmes by end 2013

Preparing for re-use – Article 3 of Directive 2008/98/EC defines preparing for re-use as 'checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing'

PAYT - 'Pay as you thrown' systems. These systems also called variable rate pricing are systems in which residents are charged according to the waste they actually produced. There are different ways of metering the waste produced either sophisticated systems where waste is weighted or more simple systems where a tax is applied per waste bag according to its volume

PPWD - Packaging and Packaging waste Directive

PRO – Producer Responsibility Organisation – collective organisation aiming at ensuring that the obligations of financing/meeting waste management targets (reuse/recycling) laying on producers/importers when they place goods on the EU market are fulfilled

Recovery – Article 3 of Directive 2008/98/EC defines recovery as 'any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy'

Recycling – Article 3 of Directive 2008/98/EC defines recycling as 'any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations'. As detailed in Annex 11, there are some differences in the definition of the concepts of 'recycling', 'recovery', 'reuse' and municipal waste between the WFD, the Landfill and the PPWD

REFIT - Regulatory Fitness and Performance (REFIT) Communication, COM (2013) 685

Re-use – Article 3 of Directive 2008/98/EC defines re-use as 'any operation by which products or components that are not waste are used again for the same purpose for which they were conceived'

Waste Hierarchy – Article 4 of Directive 2008/98/EC makes the waste hierarchy a 'priority order' in waste prevention and management legislation and policy, and defines it as, in order of preference: (a) prevention; (b) preparing for re-use; (c) recycling; (d) other recovery, e.g. energy recovery; and (e) disposal

Waste prevention – Article 4 of Directive 2008/98/EC defines prevention as 'measures taken before a substance, material or product has become waste, that reduce: (a) the quantity of waste, including through the re-use of products or the extension of the life span of products; (b) the adverse impacts of the generated waste on the environment and human health; or (c) the content of harmful substances in materials and products'

Waste TS – Thematic Strategy on the Prevention and Recycling of Waste COM (2005) 666 adopted in December 2005

WEEE - waste from electric and electronic equipment

WFD – Waste Framework Directive originally adopted in 1975 and revised in 2008 as Directive 2008/98/EC

ANNEX 2: LIST OF STUDIES AND SOURCES USED IN THE IMPACT ASSESSMENT

1) Target review project, DG ENV support contract for the preparation of the impact assessment, Eunomia with Argus, Öko Institute and Copenhagen Resource Institute and Satsuma Media, final report in approbation process, http://www.wastetargetsreview.eu/
2) Past and future climate benefits from better municipal waste management in Europe, EEA 2011, http://www.eea.europa.eu/publications/waste-opportunities-84-past-and
3) Technological, Socio-Economic and Cost-Benefit Assessments Related to the Implementation and Further Development of EU Waste Legislation, Eunomia with Argus, Öko Institute and Copenhagen Resource Institute and Satsuma Media, final report in approbation process, http://www.wastemodel.eu/
4) Use of economic instruments and waste management performances, Bio Intelligence Service with IEEP, Eunomia, Ecologic, Arcadis and Umweltbundesamt, April 2012, http://ec.europa.eu/environment/waste/pdf/final_report_10042012.pdf
5) Application of the 'producer responsibility' principle in the context of waste management, Bio Intelligence Service with IEEP, Eunomia, Ecologic, Arcadis and Umweltbundesamt, December 2013, http://epr.eu-smr.eu/
6) Support to Member States in improving waste management based on assessment of Member States' performances, Final report, May 2013, BiPro with Arcadis and Enviroplan, http://ec.europa.eu/environment/waste/framework/support_implementation.htm
7) Managing municipal solid waste – a review of achievements in 32 European countries, EEA report N° 2/2013, EEA 2013, http://www.eea.europa.eu/publications/managing-municipal-solid-waste
8) Treating waste as a Resource for the EU Industry. Analysis of Various Waste Streams and the Competitiveness of their Client Industries - Final report, ECSIP Consortium for the European Commission, DG ENTR, August 2013
9) Study of the largest loopholes within the flow of packaging material, Bipro Final Report (ENV.D.2/ETU/2011/0043)
10) Implementing EU Waste Legislation for Green Growth – Final report, Bio Intelligence Service for the European Commission DG ENV, November 2011 http://ec.europa.eu/environment/waste/studies/pdf/study%2012%20FINAL%20REPORT.pdf
11) EEA report 8/2011, "Earnings, jobs and innovation – the role of recycling in a green economy", EEA 2011
12) Resource saving and CO2 reduction potentials in waste management in Europe and the possible contribution to the 2020 CO2 reduction target in 2020, PROGNOS and IFEU, October 2008 http://www.prognos.com/CO2-study.609.0.html
13) Is structural measures funding for municipal waste management infrastructure projects effective in helping Member States achieve EU waste policy objectives? European Court Auditor special report N° 20, 2012 http://www.eca.europa.eu/

14) Municipal Solid Waste Management Capacities in Europe (Draft), EEA-ETC/SCP, January 2014

15) Investment potential for the treatment of bio and recyclable municipal waste in the EU, final report, EIB with the support of Prognos and Lameyer KW consult, November 2013

16) How to improve EU legislation to tackle marine litter, IEEP for Seas at Risk, July 2013

17) Assessment of cumulative cost impact for the steel (2013) and aluminium industry (2013), http://ec.europa.eu/enterprise/sectors/metals-minerals/files/steel-cum-cost-imp_en.pdf and http://ec.europa.eu/enterprise/sectors/metals-minerals/files/final-report-aluminium_en.pdf

18) EEA 2010 derived from SERI GLOBAL 2000, Friends of the Earth Europe (2009), see: www.seri.at/resource -report

19) Mapping resource price – the past and the future, Ecorys 2012

20) Diverting waste from landfill - Effectiveness of waste-management policies in the European Union. EEA Report No 7/2009, http://www.eea.europa.eu/publications/diverting-waste-from-landfill-effectiveness-of-waste-management-policies-in-the-european-union

21) Danish Government (2013) Denmark Without Waste: Recycle More - Incinerate Less, November 2013, http://www.mst.dk/NR/rdonlyres/EBE9E5D4-B765-4D4E-9954-9B713846E4CF/162130/Ressourcestrategi_UK_web.pdf

22) Jakus P. M., et al. (1996) Generation of Recyclables by Rural Households, Journal of Agricultural and Resource Economics, Vol 21 (1), pp 96-108; and Tiller K. H., et al. (1997) Household Willingness to Pay for Dropoff Recycling, Journal of Agricultural and Resource Economics, Vol 22 (2), pp 310-320). A. Bruvoll, B. Halvorsen and K. Nyborg (2002), Households' Recycling Efforts, Resources, Conservation and Recycling, 36: 337-354

23) Bipro Final Report (ENV.D.2/ETU/2011/0043): Study of the largest loopholes within the flow of packaging material, p. 22

24) Analysis of the key contribution to resource efficiency, BIO Intelligence Service for DG ENV, April 2012

25) EIMPack (2011) *Economic Impact of the Packaging and Packaging Waste Directive – literature review*, http://eimpack.ist.utl.pt/docs/Literature%20Review_final.pdf.

26) ECOLAS and PIRA (2005) *Study on the implementation of the Directive 94/62/EC on Packaging and Packaging Waste and Options to Strengthen Prevention and Re-use of Packaging*, http://ec.europa.eu/environment/waste/studies/packaging/050224_final_report.pdf

ANNEX 3: SUMMARY OF THE MAIN ELEMENTS OF THE STAKEHOLDER CONSULTATION

Several categories of stakeholder were consulted in the context of this IA: proper waste management involves several actors including citizens, environmental NGO's, public authorities - from municipal, regional to national levels, public or private waste management operators and industries placing goods on the market involved in extended producer responsibility (EPR) schemes.

A preliminary consultation of 30 main European stakeholders was organised during the first months of 2013. On this basis, the main themes for the review were identified and a questionnaire was placed online for 14 weeks - between 4th June and 10th September 2013. Additional in-depth consultations of key stakeholders and MS were organised including 20 country visits between April and July 2013 to discuss the assumptions used in the model and preliminary results from the model. Two specific websites - one on the target review and another on the model - were developed to inform stakeholders on progress and allowed for further suggestions and comments.[1]

As local and regional authorities are key players in waste management, an 'outlook' opinion was solicited by the Commission from the Committee of the Regions. This opinion was adopted on 4th July 2013. A summary of the main recommendations is given below.

An additional online consultation was also organised on the establishment of a marine litter reduction target, while a conference dedicated to the prevention and management of marine litter in European seas was organised in April 2013 in Berlin.[2]

Additional presentations and discussions were organised around the target review including in the relevant waste technical Committees created under the 3 Directives and also workshops and seminars organised by key stakeholders. For instance, a specific seminar on the application of the producer responsibility principle was organised in September 2013, and was followed up by a stakeholder consultation on the possible contents of guidance at EU level.

The results of the consultations on the Green paper on plastic waste including the report of the Parliament on the Green paper[3] were also taken into account, as well as the results of a specific seminar focusing on SME's and waste management held in December 2013 in follow-up of the findings of the Top 10 most burdensome legislative acts for SME's.

On line consultation

Questions were asked on the relevance of the issues pre-identified for the target review and on this basis on the options proposed to solve these issues. Respondents were asked to 'score' the proposed pre identified options as well as to give their views on the possible evolution of the targets. They were invited to propose additional issues and options to be considered. The results of the consultation have been divided up to show the views of the different groups of stakeholders - Industry, NGOs, Academics, Public authorities and European Citizens. [4]

A total of 670 responses were received during the consultation of which 216 from industry, 54 from NGO's, 49 from public authorities – whether National or Regional/local, 325 from

[1] http://www.wastemodel.eu/ and http://www.wastetargetsreview.eu/

[2] Full details of the conference, including the conclusions, are available at: http://www.marine-litter-conference-berlin.info/

[3] http://www.europarl.europa.eu/plenary/en/texts-adopted.html

[4] The questionnaire and the results from the consultation are available from the following link: http://www.wastetargetsreview.eu/section.php/4/1/consultation

citizens and 26 from other organisations including academic Institutions. Detailed results of the on line consultation are provided in

Annex 4.

A consultation on the establishment of a reduction target for marine litter was also organised, asking respondents to identify relevant criteria for assessing possible litter reduction actions and to evaluate the effectiveness of such actions. 437 responses to the online questionnaire were received, predominantly from consumers/interested individuals (273 responses). NGOs (43 responses), academics/scientists (39 responses) and sectoral/industrial representatives (38 responses) were among those represented comparatively strongly. 8 local/regional authorities and 8 national authorities also responded.

Committee of the Regions- summary of the outlook opinion

On 4th July 2013, the Committee of the Regions issued an 'outlook opinion' on the waste target review. In summary, the Committee recommended the following measures:

- the introduction of more stringent standards with respect to waste prevention, based on the best results obtained to date. By 2020, the quantity of municipal waste generated per person should be reduced by 10% in comparison with the levels recorded in 2010;
- Member States to be given binding, quantitative, separate, minimum targets for each category of waste that is defined as reusable;
- raising the current mandatory target for the recycling of solid municipal waste to 70% by 2025, with intermediate targets and transitional periods to be negotiated;
- the adoption of recycling targets for industrial waste. These targets could be set for specific types of material rather than types of waste and should be just as ambitious as those set for household waste;
- adopting the most stringent common standards for waste sorting and cleaning. By 2020, 100% of waste should be subjected to selective sorting;
- the landfilling of all forms of organic or biodegradable waste that can be reused, wholly or partly recycled or that has value in terms of energy recovery, to be prohibited by 2020;
- the targets for recycling plastic packaging – for plastics of all kinds – to be raised to 70%, and the recycling targets for glass, metal, paper, cardboard and wood to 80%.

Summary of the consultation on EPR

56 stakeholders sent their feedback to the written consultation out of which: 22 industry and industry federations, 12 Producer Responsibility Organisations (PROs), 9 treatment operators, 1 solid waste management association, 5 regional and local authorities, 2 national authorities, 1 expert and 4 NGOs.

73% of the respondents agree that in general, an initiative by the European Commission, aiming at clarifying the scope, definition and objectives of EPR, and at defining common principles and minimal requirements for their implementation, is necessary through a combination of guidance/recommendations and legislation.

More than half of the respondents (53%) agree that the EPR definition, scope and objectives should be clarified, and some examples of key principles that should be included in the new definition were given. 67% of the stakeholders agreed that responsibilities should be shared and clearly defined along the whole supply chain. Treatment and waste management operators suggested including in the Packaging and Packaging Waste Directive a provision which requires Member States to assign roles and responsibilities to public authorities and economic operators within the concept of shared responsibility for packaging waste management.

51% of the stakeholders also agree on the fact that, a clear and stable framework is necessary, in order to ensure fair competition. However, 32% failed to agree with all the aspects proposed by the guidance. Some stakeholders go beyond and recommend additional restrictions in the way competition takes place within EPR, for example by imposing a single PRO for each product category. 84% of the respondents agreed that a clearing house is likely to be a valuable addition to the national systems, especially in certain circumstances, for example when several PROs are competing.

Depending on the nature of the stakeholder, there are divergent opinions with regards to the establishment of a full cost for end-of-life products, in line with the polluter pays principle. An isolated number of stakeholders believe that EPR is not an implementation of the polluter-pays-principle.

Almost half of the respondents agree that the fees paid by a producer to a collective scheme should reflect the true end-of-life management costs of his products. Some actors agree with the fact that there is a clear need of modulation of the fees in relationship with the waste hierarchy. 12.5% partially disagree with the guidance, as according to some, there is no point in independent third parties establishing true costs.

More than 55% of stakeholders seem to agree that transparency of performances and costs is necessary. However, according to some, full transparency has limits when for example, competition does exist between PROs and confidentiality of some information is mandatory.

The majority of stakeholders (83%) agreed that the harmonisation of key definitions and reporting modalities is needed at the European level. According to waste management stakeholders, the revision of the Packaging and Packaging Waste Directive should contain harmonised definitions.

Finally, 60% of stakeholders agree that both MS and obliged industry are responsible for the enforcement, and should ensure that the adequate means for monitoring and control are in place. Several methods of responsibility-sharing were proposed by different stakeholders.

Main signals coming from the consultations

In summary, some elements were consistently 'scored' high by most of the stakeholders as essential options for further consideration, including the need to:

- improve the credibility of statistics;
- improve reporting and monitoring methods, and improve and clarify existing definitions in the Directives
- simplify and make the targets more consistent
- take into account the divergent starting point between MS; and
- take additional measures at EU level other than setting targets such promoting the use of economic instruments and developing EU guidance on EPR schemes.

There was also broad support for extending some of the existing targets, most notably for recycling (85% of all respondents in favour), and to take additional measures to limit landfilling or incineration (57% of all respondents in favour of maximum ceilings). Fixing targets for waste prevention, (preparation for) re-use and/or other waste streams received mixed responses, with different stakeholder groups having fairly divided opinions on this.

The results from the consultation on the Green paper on plastic waste confirmed the necessity to take additional actions at EU level notably to prevent plastics waste from being landfilled

and to dramatically increase the recycling rates of plastics in the EU.[5] The European Parliament in its report[13] called for an obligation to collect and sort 80% of plastic waste, discourage incineration and phase out landfilling of plastic waste.

The majority of the respondents to the consultation on EPR (73%) are in favour of an initiative by the European Commission, aiming at clarifying the scope, definition and objectives of EPR, and at defining common principles and minimal requirements for their implementation through a combination of guidance/recommendations and legislation.

During the seminar with SME's different measures to simplify the legislation were suggested notably to exempt SME's handling small quantities of waste from some registration and permitting procedures.

From the marine litter consultation, the effectiveness and feasibility of actions were found to be the most relevant criteria when evaluating possible actions to combat marine litter. From the possible sector-specific actions outlined, avoiding littering behaviour and shifting away from single-use plastic bags and bottles, (in the case of consumers), awareness-raising and improved enforcement of littering rules (in the case of local and regional authorities) and extending producer responsibility over the whole product lifecycle and the development of an EU-wide harmonised monitoring strategy (EU policymakers) were among the most widely-supported actions. [6]

[5] Results from the consultation on the Green paper are available from the following link: http://ec.europa.eu/environment/consultations/plastic_waste_en.htm

[6] Results from the consultation on marine litter will be made available from the following link: http://ec.europa.eu/environment/consultations/marine_litter_en.htm

ANNEX 4: DETAILED RESULTS OF THE ON LINE CONSULTATION ON THE TARGET REVIEW

(Separate document)

ANNEX 5: ATTAINMENT OF THE EUROPEAN WASTE TARGETS

➢ Municipal waste target

As detailed in Box 1, the 50% preparation for reuse/recycling target for municipal waste is applicable by 2020 and MS can choose from any of four measurement methods as to whether the target has been met or not. According to the 2010 Eurostat statistics, 7 MS are recycling more than 40%, 7 MS are recycling between 30 and 40% and the 14 remaining MS are below 30%.

As explained in section 2.2 below, Eurostat data on recycling are similar to the most demanding method – method 4 - for assessing whether the target is met or not, the other methods providing higher recycling rates, and so making it easier to meet the target.

According to the EEA report[7], under the most demanding method around 14 MS would be able to meet the target by 2020 at their existing rate of progress. 8 MS will have to accelerate their recycling at annual rates which were previously met only in the most advanced MS. For the 6 remaining MS (SK, HR, BU, RO, LV, LT), meeting the 50% target with the most demanding measurement method by 2020 would require an acceleration of recycling rates at a level faster than any found so far in other MS.

In other words, nearly half the MS will have to use another measurement method to demonstrate compliance with the target on time – which is perfectly permitted according to the WFD and the related Commission Decision – see **Error! Reference source not found.**. The results from the model confirm this finding – see Table 1 below.

	Target Met				Distance to Target, %			
Method used	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Austria	Yes	Yes	Yes	Yes	8%	24%	9%	9%
Belgium	Yes	Yes	Yes	Yes	4%	27%	5%	5%
Bulgaria	Yes	Yes	No	No	0%	6%	-26%	-26%
Croatia	No	No	No	No	-20%	-19%	-31%	-31%
Cyprus	No	No	No	No	-15%	-12%	-29%	-29%
Czech Republic	Yes	Yes	No	No	0%	0%	-25%	-25%
Denmark	Yes	Yes	Yes	Yes	12%	19%	5%	5%
Estonia	No	Yes	No	No	-6%	0%	-17%	-17%
Finland	No	Yes	No	No	-6%	3%	-14%	-14%
France	No	Yes	No	No	-15%	5%	-12%	-12%
Germany	Yes	Yes	Yes	Yes	24%	23%	14%	14%
Greece	No	No	No	No	-12%	-9%	-25%	-25%
Hungary	No	Yes	No	No	-5%	2%	-19%	-19%
Ireland	Yes	Yes	Yes	Yes	10%	20%	2%	2%

[7] Reference 7 in Annex 2

Italy	No	Yes	No	No	-2%	7%	-8%	-8%
Latvia	No	No	No	No	-12%	-11%	-33%	-33%
Lithuania	No	Yes	No	No	-3%	2%	-21%	-21%
Luxembourg	Yes	Yes	No	No	10%	22%	0%	0%
Malta	No	No	No	No	-27%	-21%	-37%	-37%
Netherlands	Yes	Yes	Yes	Yes	2%	25%	3%	3%
Poland	No	No	No	No	-17%	-15%	-30%	-30%
Portugal	No	No	No	No	-21%	-21%	-38%	-38%
Romania	No	No	No	No	-24%	-20%	-37%	-37%
Slovakia	No	No	No	No	-16%	-10%	-31%	-31%
Slovenia	No	Yes	No	No	-1%	5%	-7%	-7%
Sweden	Yes	Yes	Yes	Yes	20%	24%	10%	10%
United Kingdom	Yes	Yes	Yes	Yes	10%	20%	2%	2%

Table 1: Modelled 2020 MSW recycling rates – BAU Scenario

- **Construction and demolition waste**

According to the recent reports provided by 11 MS on the implementation of the WFD - reports due by September 2013, 4 MS have already met the 2020 material recovery target, 3 MS reported rates below 50% and 4 MS reported rates between 50 and 70% - see **Error! Reference source not found.**.

Figure 1 below shows approximate values for material recovery rates for mineral C/D waste estimated on the basis of the Eurostat data. [8] In summary, it seems that 2/3 of the MS will be able to meet the 70% target in the relatively short term. Additional efforts will be required for the other MS, knowing that the target has to be met by 2020 – 10 years after this estimation - which gives enough time to react for the remaining MS.

[8] Reference 1 in Annex 2

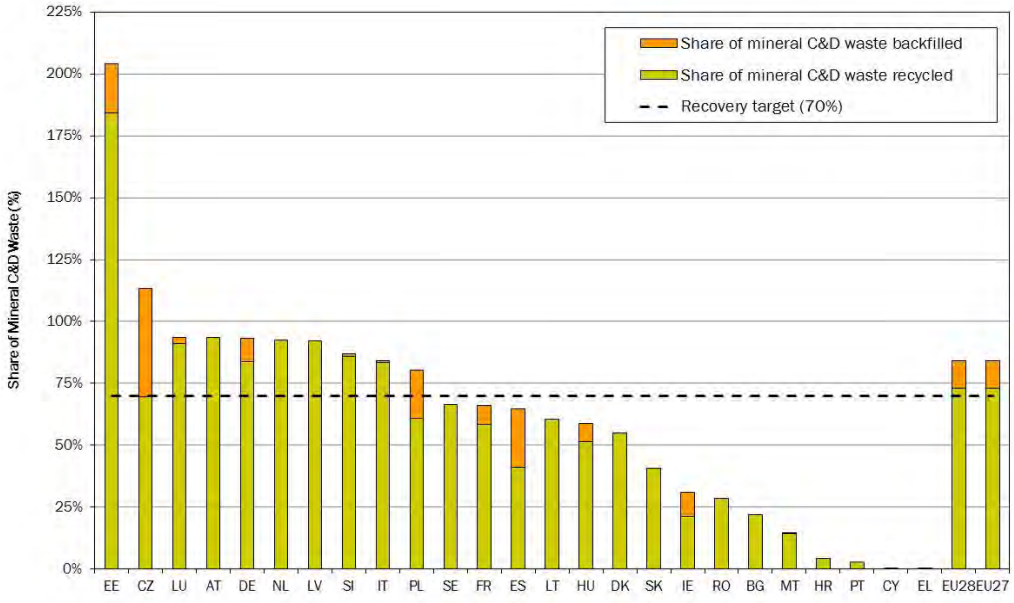


Figure 1: Approximate values for recovery rates for C&D Waste (2010)[9]

- **Packaging and packaging waste target**

Figure 2 and **Error! Reference source not found.** below summarise the current performances of the MS compared to the PPWD targets. In summary, 21 MS are exceeding the 55% overall recycling target, with most MS well on track to meet the deadlines taking into account the additional time offered to those with derogations. 26 MS have surpassed the targets for paper/cardboard and plastics, 25 MS for wood, 23 MS for metals and 19 MS for glass. In the fitness check it is highlighted that generally speaking higher recycling rates are achieved for commercial and industrial packaging waste with household packaging lagging behind. The performances achieved by the 3 most advanced MS – the 'top 3' MS – give an indication of the potential for future progress.

[9] Data above 100% for EE and CZ seems to be linked with differences between reporting times between C/D waste generated and treated (storage) and imports of mineral waste treated in EE and CZ

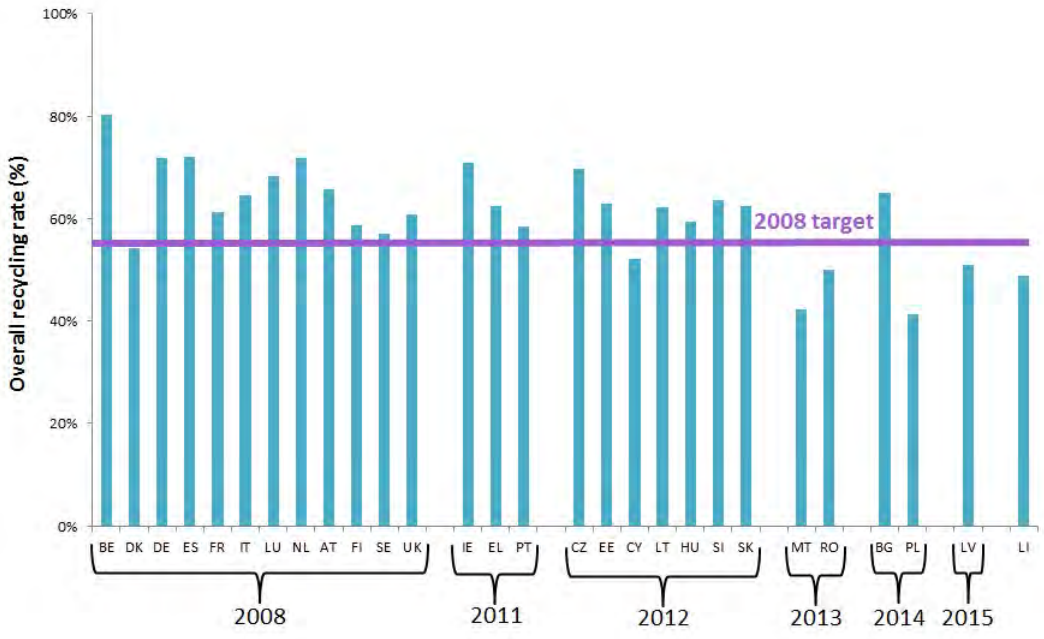


Figure 2: Packaging recycling rates 2011[10]

- **Landfill diversion target**

Figure 3 and Figure 4[11] show the compliance status of MS with or without a time derogation period for meeting the landfill diversion target for biodegradable municipal waste. These data indicate that around 23 MS are on track to meet the target on time – i.e. either by 2016, or by 2020 with derogation. For the remaining MS, additional efforts will be necessary. At the other extreme, 6 MS are far beyond the target – landfilling below 5% of their 1995 levels.

[10] Source: Eurostat 2013

[11] Extracted from the EEA report, reference 7 in Annex 2, updated in 2014. 2010 and/or 2011data are estimated for FR, IT, LU, NL, SE, HR and RO. 2009 data are estimated for BG, PL and PT. 2009 data were used for 2010 and 2011 for SP and SK

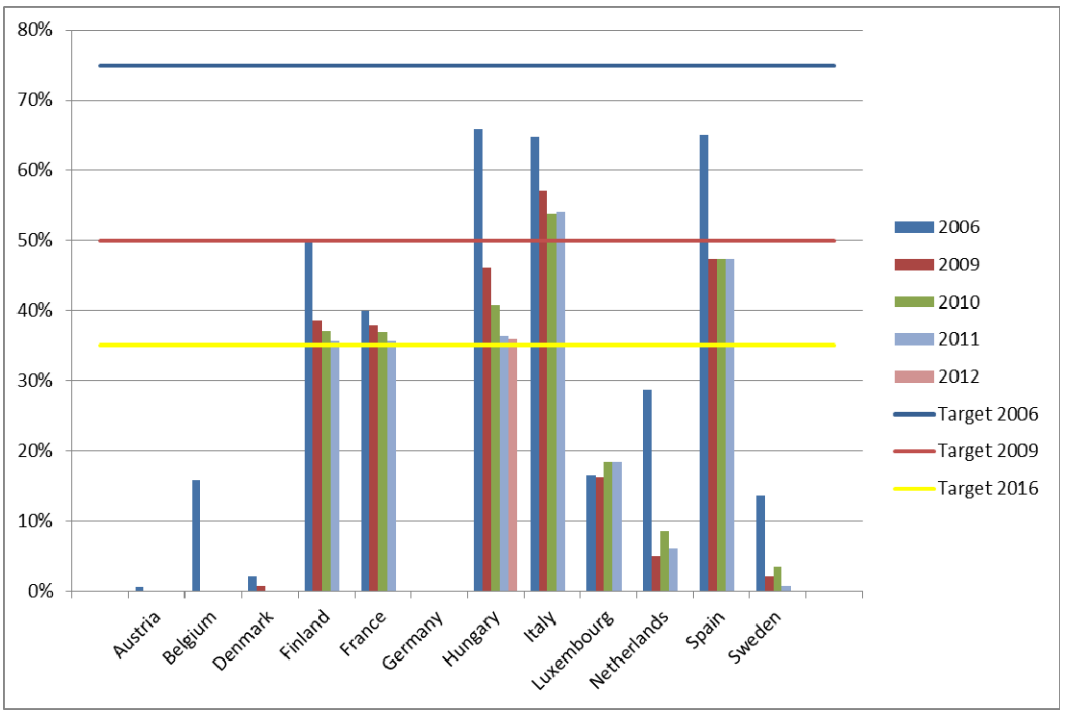


Figure 3: Percentage of biodegradable MSW landfilled compared to 1995

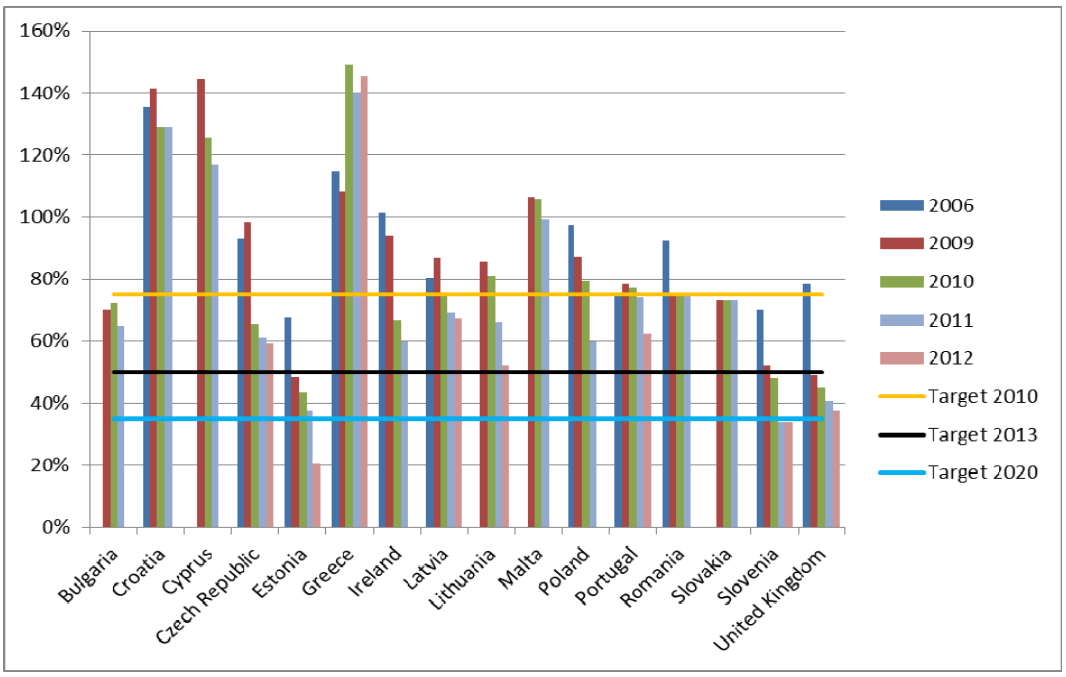


Figure 4: Percentage of biodegradable MSW landfilled vs 1995 - MS with derogations

ANNEX 6: MAIN REASONS FOR REJECTING SOME OPTIONS

During the stakeholder consultation around 60 different pre-defined measures were considered in addition to open questions allowing stakeholders to suggest additional measures that had not already been identified. These measures were scrutinised in detail in light of the above objectives, their appropriateness for implementation in the EU, and the views expressed by stakeholders.

Scope of the target review

Targets for **industrial and commercial** packaging **waste** are already included in the EU waste legislation. Their reinforcement is discussed in the IA. These targets might be complemented by options that restrict the landfilling of recyclable waste which would also address industrial and commercial waste insofar as it is currently landfilled. Commercial waste is also partly covered by the targets on municipal waste at least for the smaller retailers covered by municipal collection systems.

Additional targets for **industrial, mining and/or commercial waste** were considered as ineffective at this stage: it is indeed questionable whether the establishment of general targets is appropriate for those waste streams. Industrial and mining waste is completely different from one sector to another: for instance waste generated by the steel industry, the food industry or the textile industry is of a very different nature and composition. A **sector-specific approach** appears to be a better option. In addition, the lack of reliable statistics remains a barrier to target-setting. Large scale industrial and mining activities are covered by BAT reference documents (BREF's) drawn up under the Industrial Emission Directive and the Mining Waste Directive that include information on the prevention of resource use and waste generation, re-use, recycling and recovery. The on-going revision of the BREFs and the adoption of BAT conclusions will strengthen the impact of these BREFs on industrial practices leading to further resource efficiency gains and increased waste recycling and recovery.

Similarly, defining **an overall target for hazardous waste** seems inappropriate for the same reasons – diversity of nature, composition and origin of this waste. There is already a clear requirement in the WFD – all hazardous waste has to be managed without endangering human health or the environment. Hazardous waste from a range of industry activities is also addressed in BAT conclusions. Moreover, the establishment of recycling targets may not be appropriate as safety considerations should prevail over other policy objectives. In fact, it is difficult to apply the waste hierarchy to the management of hazardous waste since safe disposal can often be the best option available. Similarly on the basis of existing evidence, fixing EU targets for **sewage sludge** in terms of prevention or recycling/composting seems inappropriate.

Reuse

Reuse may appear as a very attractive option for specific waste streams such as textile, packaging, furniture and electric and electronic waste (however WEEE is not covered by this review exercise). Reuse of textiles and furniture could be encouraged through an increase of the overall municipal waste preparation for re-use and recycling target as it might be

accounted for meeting the overall target as it includes preparation for re-use. Re-use should also be encouraged for packaging through an adaptation of the existing recycling target of the PPWD to include preparation for re-use as it is the case for municipal waste. As explained in the fitness check, the environmental benefits of reusable packaging are dependent on a number of factors including transportation distance. Therefore fixing specific legally binding targets for reusable packaging appears to be excessive as local conditions have to be taken into account. As with the waste prevention targets, MS should be encouraged to establish re-use targets in their NPPs and to support the work of third sector organizations in preparing items for reuse. In some MS such as in France, targets for reuse were introduced in the context of EPR schemes for furniture. Nevertheless, defining specific targets for re-use or preparation for re-use has been rejected at this stage mainly for data availability and enforcement reasons: it has been so far extremely difficult to isolate data on reuse or preparation for reuse in the waste statistics.

EPR schemes

Imposing completely harmonized conditions for all EU EPR schemes and/or obliging MS to put in place EPR schemes for specific waste streams is an option to be rejected for several reasons including subsidiarity considerations, but also due to the fact that some flexibility should be left to MS in the practical organization of their EPR systems as long as some minimum essential requirements are defined.

Material based target for municipal waste

Defining **material based reuse/recycling targets for municipal waste** seems to be unnecessary and should be rejected as meeting ambitious recycling targets for municipal waste will imply that the majority of potentially recyclable materials – whether from the dry - plastics, glass, metals, paper, textile, etc - or the wet - food and garden waste - fraction of municipal waste would have been separately collected and recycled. It could, though, contribute to higher recycling rates of Critical Raw Materials – particularly when electric and electronic waste equipment (WEEE) are concerned. However, the scope of the present target review does not include the WEEE Directive. Furthermore, imposing additional material-based targets and the related reporting obligation on the MS appears to be disproportionate while limiting the flexibility which should be left to the MS to ensure that local conditions and specific waste composition are taken into account when planning separate collection actions. This conclusion also applies to specific targets for instance for textile or biowaste even if these options were identified as attractive by some stakeholder during the consultation.

Maximum targets for incineration

Increasing the minimum recycling/reuse rate to around 70% in the medium term implies de facto that incineration will be limited to a maximum of 30% of waste generated which would broadly corresponds to the concept ‘not recyclable’ waste on the basis of the experience of the most advanced MS/regions. Therefore the option of **defining a maximum target for incineration** appears to have a very limited added value and should therefore be rejected, notably to keep the legislation as simple as possible.

ANNEX 7 : SUMMARY OF MS REPORTING OBLIGATIONS

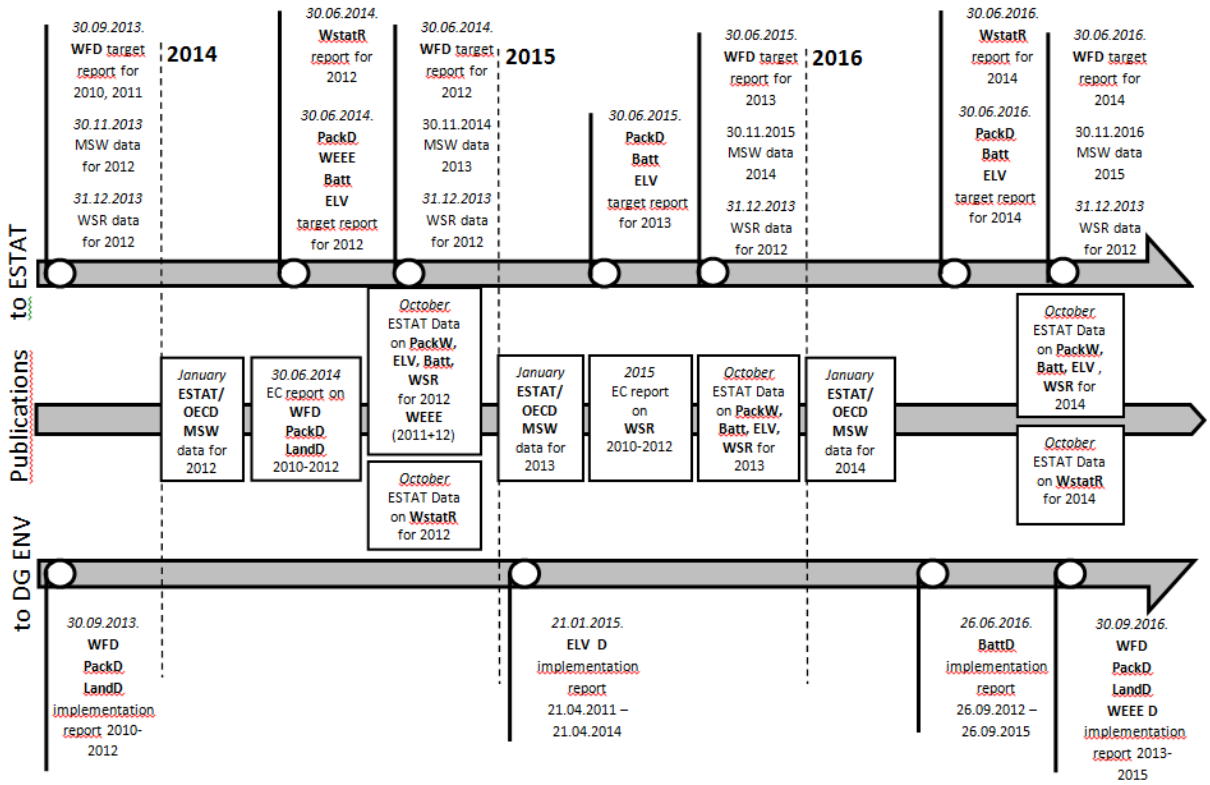


Figure 5: Summary of MS reporting obligations on a 3 year period

	to DG ENV	to ESTAT	to DG ENV	to ESTAT	to DG ENV	to ESTAT	
DIRECTIVE	REPORTING PERIOD		DATA		PLATFORM		EXTRA
*Waste Framework Directive 2008/98/EC	Triennial (2008/98/EC, Art. 37) 2010-2012, 2013-2015 …	Annual (according to one of the methods laid down in Commission Decision 2011/759/EU)	Narrative implementation report + data on recovery and recycling rates for household and similar waste + recovery rate for construction and demolition waste	• Recycling rates and meeting the targets for municipal waste and construction and demolition waste (2008/98/EC, Art. 11(2))	Questionnaire defined by Commission Implementing Decision of 18.04.2012.	eDAMIS	
**Packaging and packaging waste directive 94/62/EC	Triennal (94/62/EC, Art. 17) 2010-2012, 2013-2015 …	Annual (according to Commission Decision 2005/270/EC)	Implementation report	• Quantities of packaging waste generated and recovered or incinerated • quantities of packaging waste sent to other MS or exported outside the EC for recovery or incineration • quantities of packaging waste generated in other MS or imported from outside the EC for recovery or incineration (2005/270/EC)	Questionnaire defined by Commission Implementing Decision of 27.05.1997. (97/622/EC)	eDAMIS	MS can submit data on a voluntary basis on: • production, exports, imports of empty packaging • reusable packaging • sub-fractions of packaging (composite packaging) • concentrations of heavy metals present in packaging • packaging waste considered to be hazardous
***Waste Statistics Regulation 2150/2002	-	Biannual (according to the Commission regulation 849/2010) 2010, 2012, 2014 …	-	• Quantities of waste generated for each waste category and each waste generating activity defined by 849/2010, Annex I, Section 2(1) and Section 8(1) • the population served by a collection scheme for mixed household or similar waste; • quantities of waste treated for each waste category and for each item of the recovery and disposal operation defined by 849/2010, Annex II, Section 2 and Section 8(2) • number and capacity of facilities for landfills, specially engineered landfills and permanent storage for hazardous, non-hazardous and inert waste • number of the same facilities as above closed since the last reference year • number of facilities for the recovery and disposal operations listed in 849/2010, Annex II, Section 8(2) excluding item 5 • capacity of facilities for the recovery and disposal operations listed in 849/2010, Annex II, Section 8(2) excluding items 3 and 5	-	eDAMIS	
****Landfill Directive 99/31/EC	Triennial (99/31/EC, Art. 15) 2010-2012, 2013-2015 …	-	Implementation report + data on the amount of biodegradable MW going to landfills + number of landfills (existing, complying with the directive, closed, re-equipped) for hazardous, non-hazardous and inert waste	*There is no direct data reporting related to the Landfill directive itself, but the Waste Statistics regulation data is used*	Questionnaire defined by the Commission decision 2000/738/EC	-	
*****EUROSTAT/OECD joint questionnaire		Annual	-	• MW generation (waste from households, other MW) • amounts designated for recovery operations (recycling, composting, incineration with energy recovery, other recovery) • amounts designated for disposal operations (incineration without energy recovery, landfill, other disposal)	-	A subset of OECD/ESTAT JQ on waste	

ANNEX 8: OVERVIEW OF THE EUROPEAN REFERENCE MODEL

(Separate document)

ANNEX 9: OVERVIEW OF THE MARINE LITTER MODULE OF THE EUROPEAN REFERENCE MODEL

General Methodology

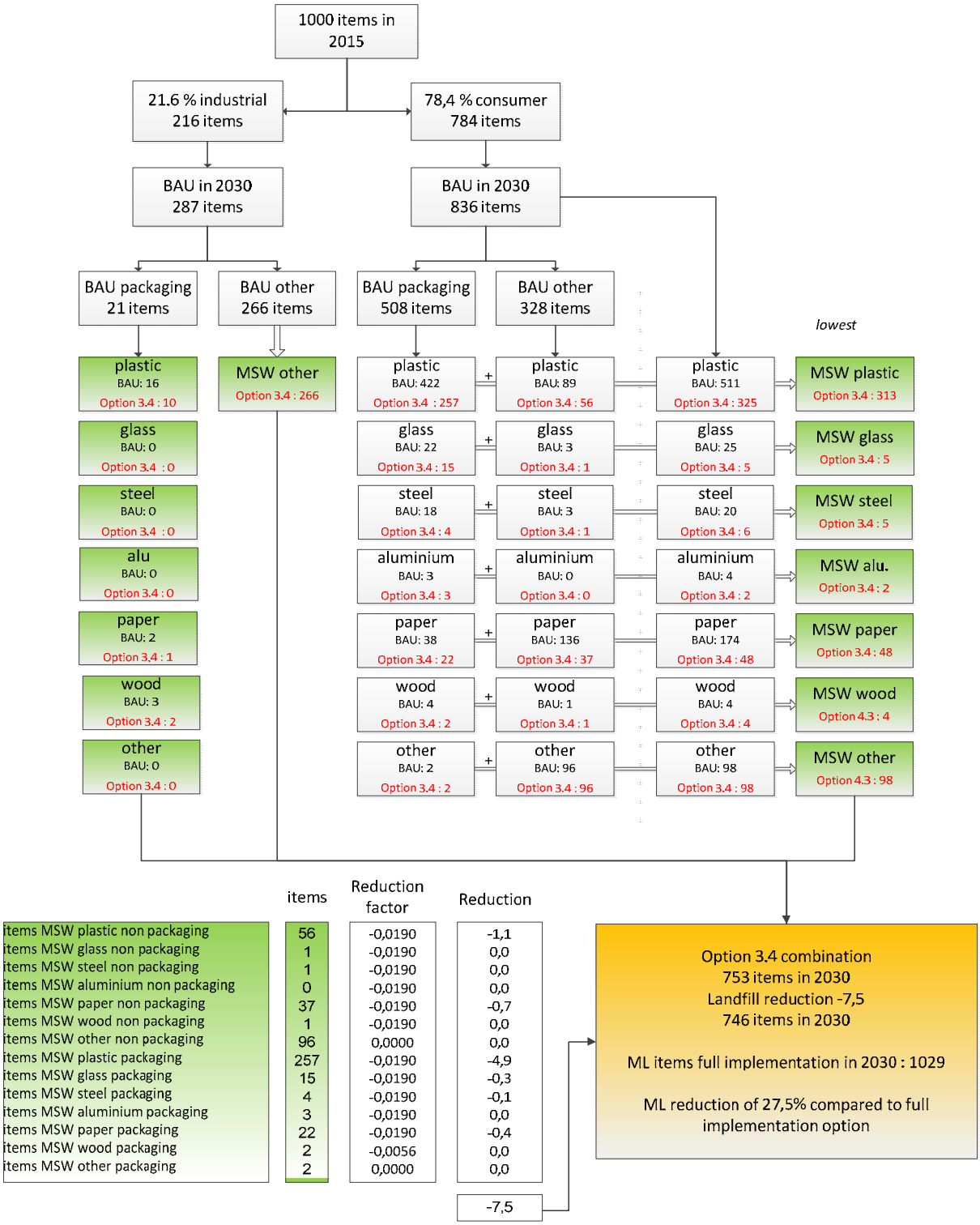
The marine environment works as a sink in which marine litter accumulates. It is very difficult to remediate accumulated old marine litter, especially when fragmented into e.g. micro-plastics. The most cost-effective way to tackle the problem is to prevent new litter from reaching the marine environment.

Recent technical guidance drawn up by the Technical Group on marine litter in the context of the Marine Strategy Framework Directive, and endorsed by Member States' Marine Directors on 5 December 2013, identifies beach litter, sea floor litter, floating litter, litter in biota and micro-litter as relevant indicators. For the purposes of this modelling exercise, beach litter is used as a proxy for marine litter, as most data are available for this type of litter, and because beach litter represents a large proportion of new litter arriving in the marine environment.

For all scenarios a similar approach is used:

- First, future waste generation is assessed, using data on actual generation and on decoupling. Time horizons to 2020 and 2030 are considered.
- Secondly, the number and type of marine litter items found in 2020 and 2030 are projected, if 1000 are found in 2015[12], in option 1 (business as usual, no policy change).
- Thirdly, the reduction impact of a given policy scenario on each litter type is assessed. Recycled waste does not contribute to marine litter. Increased recycling reduces marine litter at source.
- For each option, the reduced number of items was calculated and compared to the number of items under the BAU (no policy change) and full implementation scenarios.
- The figure below illustrates the anticipated decrease from option 3.4, to the 2030 time horizon. The black figure represents the number of items in the BAU scenario. The red figure represents the diminished number of items in the selected option. In the case of overlapping targets (e.g. MSW and packaging waste), the target with the largest reduction impact is considered definitive.

[12] 2015 is used as the baseline, as it will be the first full year for which Member State data on the presence of beach litter will be available under the monitoring programmes foreseen under Article 11 of the Marine Strategy Framework Directive (Directive 2008/56/EC).



No Policy Changes

In this case, recycling performance and levels of landfilling remain unaltered. We project levels of future waste generation and assume marine litter is correlated in a linear way to it. We assume that litter source is divided as follows between items of consumer origin and those of industrial origin. We know the balance between consumer and industrial for those items where the distinction could easily be observed. We recalculate the number of items where the origin is unclear or unknown using the same proportions:

ratio	baltic	black	med	north		baltic	black	med	north
consumer (CSW)	46.24%	82.12%	91.43%	32.62%		58.19%	86.87%	84.24%	54.09%
industrial	34.66%	12.84%	5.58%	27.69%		41.81%	13.13%	5.76%	45.91%
unknown	17.11%	5.25%	2.99%	39.70%					
						100.00%	100.00%	100.00%	100.00%

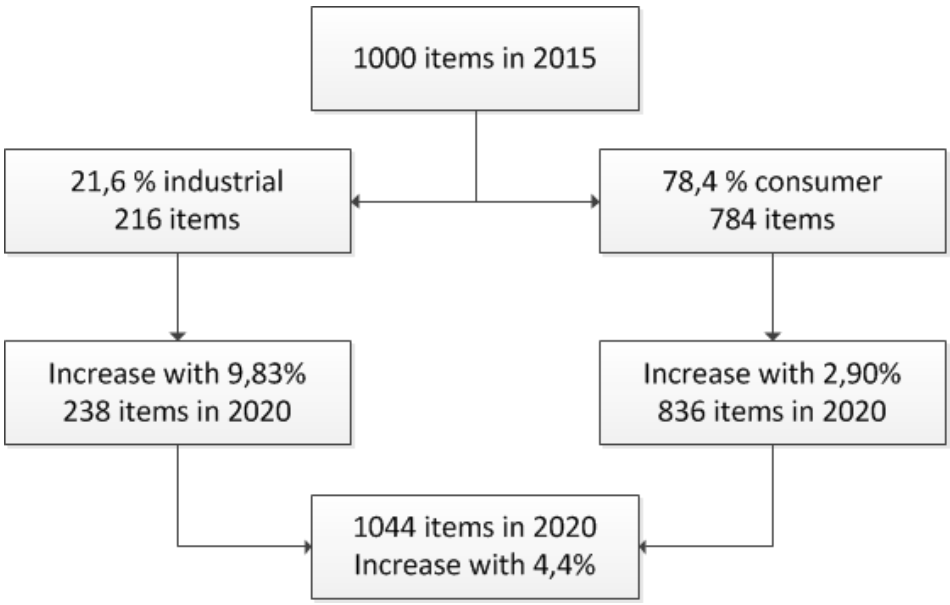
Coastlines are assessed as follows:

	Km	Share of coastline
Baltic Sea	13.456	27%
Mediterranean Sea	16.628	33%
North East Atlantic	19.885	39%
Black Sea	631	1%
Total coast line	50.600	100%

Only coastlines of countries within the EU territory are included, since the reduction target only focuses on measures for reducing marine litter within the EU and since the detailed analysis of the surveys proves that the on-site generation/disposal of litter on beaches or its transportation over relatively short distances prevails. Beach litter originates from land-based activities for between 53% (North Sea) and 93% (Black Sea) of items while between 2% (Black sea) and 27% (North Sea) of beach litter items are likely to be transported over a long distances.

Taking into account the EU-beach length for each of the regional seas, we assess the distribution between industrial and consumer for the whole of the EU as: 68% consumer origin, 32% industrial origin.

For 1000 marine litter items found in 2015, we calculate that 104 items may be found in 2020 under a business as usual scenario, and thus that marine litter inflow will increase by 4,4%.



Conclusion: with no policy change new marine litter inflow tends to increase by 4.4% in 2020 compared to 2015. It would increase by 12.3% by 2030.

Option 1: Full implementation of existing legislation

In this option we assume that all Member States comply with existing targets.

For consumer waste (MSW), we assess the degree to which complying with the current legislation leads to a reduction in the potential source of marine litter (i.e. the non-recycled fraction). We apply the MSW recycling targets to the total number of items, and apply the packaging recycling targets to the MSW packaging items specifically. These targets are partially overlapping, and both must be met; we thus take into account the outcome effecting the highest reduction.

In general, we apply full compliance with packaging recycling targets (but nothing more). However in some cases, these performance levels have already been surpassed. In such cases, we assume that the higher recycling percentages will not decrease.

For litter from industrial sources (i.e. other than MSW), we assess the effect of the targets on the industrial packaging fraction.

We calculate the 'business as usual' number of marine litter items in 2020 and 2030, assuming that in 2015 there are 1000 items. We subtract from this figure the effects of targets leading to a reduction of the litter source, as calculated above, and we assess the possible marine litter reduction in the full implementation option.

Conclusion: under option 1 (full implementation of existing legislation), new marine litter inflow tends to decrease by 4.6% in 2020 compared to 2015. It would increase by 2.9% in 2030 without further policy action.

Option 3.1: 70% recycling by 2030

In this scenario we apply a 70% overall recycling rate for municipal waste, with reassessed recycling performances for the different MSW fractions.

Since no change to the target is proposed for 2020, at the time horizon to 2020, this scenario is exactly the same as option 1 (full implementation). However, the impact of a 70% recycling target by 2030 is significant, especially given the anticipated growth in waste generation (and thus marine litter) without additional measures and the effect of allowing only one measurement method for the WFD. This option sees new marine litter inflows which are 10% lower than those projected by the full implementation of existing legislation only.

Conclusion: under option 3.1 (70% recycling by 2030), new marine litter inflow tends to be 10% lower in 2030 than under the full implementation scenario.

Option 3.2: modernised packaging waste targets

Packaging waste targets are as in **Error! Reference source not found.** in the main body of this Impact Assessment.

As no detailed data on metal marine litter is available from the OSPAR screenings, we assume the same ratio between steel packaging and aluminium packaging for marine litter as is the case for general waste statistics: an average of 15% aluminium and 85% steel packaging, based upon EUROSTAT data. The increased recycling targets for material streams which frequently end up as marine litter have a significant reduction impact at both the 2020 and 2030 timescales.

Conclusion: under option 3.2 (increased packaging waste targets), new marine litter inflow tends to decrease by 12% by 2020 and by 21% by 2030 when compared to the full implementation scenario.

Option 3.3 limiting landfilling to residual waste

Waste generation, the ratios of municipal/industrial, MSW and packaging waste recycling targets are the same as in the single measurement option.

Legal landfill is already a relatively minor source for marine litter:

	Baltic sea	Black sea	Mediterranean	North sea
Landfills and dumpsites as a ML source	0,94%	3,88%	0,14%	1,09%

On average, taking into account the coastal length of each sea, the probability for marine litter inflow to originate from landfills and dumpsites (e.g. landfill escapes) is 0,68% of all litter inflow. The introduction of landfill bans is thus of modest impact. This does not take account of escapes from illegal landfills, which goes beyond the scope of this Impact Assessment.

Conclusion: option 3.3 (limiting landfilling) is of negligible impact on new marine litter inflow at both 2020 and 2030 time horizons.

Option 3.4: combining options 3.1, 3.2 and 3.3

The highest parameter values for the options 3.1, 32 and 3.3 are combined. The combined impact is significant in that projected new marine litter inflows are found to be 13% lower (by 2020) and 27,5% lower (by 2030) than those projected by the full implementation of existing legislation only.

Conclusion: under the option 3.4 new marine litter inflow tends to decrease by 13% by 2020 and 27,5% by 2030 when compared to the full implementation scenario.

Costs related to marine litter

This section provides an assessment of the costs associated with the current degradation of the marine environment, using a **cost-based approach.** Unit costs from literature have been extrapolated to the EU level on a sectoral basis.

Coastal and beach cleaning

Cleaning costs highlighted in existing literature are highlighted below:

Beach type	Cost per km (€)	*year data*	Location	Sea[13]
Bathing	34.450	*2010*	Touristic beaches Netherlands & Belgium,10 municipalities	NS
	28.320	*2010*	Touristic beaches; Netherlands, 6 municipalities	NS
	38.190	*2010*	Spain: bathing beach	MED
	31.796	*2010*	Portugal: bathing beach	ATL
Non-bathing	214	*2010*	Sweden, non-bathing beach	BAL
	372	*2010*	Denmark, non-bathing beach	NS
Bathing & non-bathing	7.150	*2010*	UK, cleaning including beaches less intensively used by tourists	NS
	3.750	*2012*	Latvia (Riga) bathing & non-bathing beach	BAL
	11.000	*2007*	NL: average total coast length	NS
	8.278	*2010*	Portugal: bathing & non bathing beach	ATL

Beach cleaning costs, per beach type (source Mouat, 2010; Arcadis, 2013 ; Reinhard et al, 2012)

The table highlights large differences in cleaning costs between bathing and non-bathing beaches. One of factors influences the frequency of cleaning is the intensity of beach use. Designated bathing beaches and the coast around the area must be cleaned regularly, in particular between Easter and September[14]. Cleaning of non-bathing beaches is less frequent. In addition, soil type is a factor affecting cost. Sandy beaches can be mechanically cleaned, which is less costly, but this is not possible in coastal areas with rocky beaches.

No data is available on the breakdown throughout the EU of bathing and non-bathing coastal areas. However, based on the results outlined in **Error! Reference source not found.** which

[13] NS: North Sea; MED: Mediterranean Sea; BAL: Baltic Sea; ATL: Atlantic Ocean;
[14] Reinhard et al (2012) assumes that the Dutch bathing beaches are cleaned 120 times a year.

covered to differing extents both bathing and non-bathing areas, a minimum, maximum and average cleaning cost have been calculated. All data have been converted to 2013 prices.

	cost per km (€)	**length of EU coastline (km)**	**cost in the EU (m€)**
Average	8.171	50.600	413,47
Minimum	3.828[15]	50.600	193,70
Maximum	12.446[16]	50.600	629,78

The estimates of cost to the tourism and recreation sector (in average €m per year) are extrapolated from individual figures of beach cleaning activities and therefore are subject to a high degree of uncertainty.

Fishing sector

The total costs of marine litter related incidents for EU fisheries are estimated using the average costs of marine litter per vessel in the Scottish fleet, analysed by Fanshawe (2002), Mouat et al (2010) and KIMO (2010)[17]. In the UK Cost Benefit Analysis for the MSFD (Cefas; 2012), average costs of litter to the fishery sector have been disaggregated into two categories. This is due to the different economic costs of marine litter impacts associated with different fishing methods.

- Incidents due to dumped catch, repairs to fishing gears and reduced fishing time by clearing nets are mainly applicable to those fisheries that have contact with the seabed.
- Incidents due to fouling are more likely to be due to litter in the water column and can therefore affect any type of fishing vessel.

These estimates should be interpreted with caution due the different probability of incidence with marine litter across the EU fleet. These estimates are based on best available evidence and some broad assumptions (simple extrapolation of Scottish North Sea data).

Costs related to marine litter on the sea bottom

Costs to the EU fishing fleet (trawlers) associated with litter incidents that involve dumping **catch, repairing fishing gear and lost earnings** as a result of reduced fishing time are estimated at **40,4 m€** per annum. The total cost has been estimated based on the average costs per vessel for this category damage, multiplied by the number of active EU vessels that use seafloor fishing gear[18].

Cost of reduced catch revenue

cost per vessel (€)	**# trawlers in the EU**	**cost for the EU (m€)**

[15] The data from the Latvian study converted to 2013 prices.
[16] The data from the Dutch study converted to 2013 prices.
[17] GBP cost data have been converted using the exchange rate Euro 1 = 0,839 GBD (dec 2013).
[18] According to the Community Fishing Fleet Register (http://ec.europa.eu/fisheries/fleet/) 12.238 trawlers (category "towed Gears") are currently in use (2013).

2.340[19]	12.238[20]	28,64

Cost of removing litter from fishing gear

cost per vessel (€)	# trawlers in the EU	cost for the EU (m€)
959[21]	12.238	11,74

Costs related to marine litter in the water column:

Costs to the total EU fishing fleet associated with litter incidents that involve **fouling (e.g. of propellers)** are estimated at between **16,8m€** per annum. The expenses of the EU fishing fleet on these kind of incidents are calculated by multiplying the average vessel costs with the number of active EU fishing vessels.[22]

Cost of broken gear, fouled propellors

cost per vessel (€)	# fishing vessels in the EU	cost for the EU (m€)
191[23]	87 667	16,79

Cost to the fishing industry amounts to a total of 57,2 m€, using the cost-based approach outlined above. These estimated costs generated by marine litter are equivalent to a reduction of nearly 1% of the total revenues that are generated by the EU fleet in 2010 (landed value of 6600 m€[24]).

Shipping sector

Marine litter also poses a navigational hazard to vessels in general. Incidents involving vessel damage caused by marine litter are widespread with over 70% of UK harbours and marinas reporting that their users had experienced incidents involving marine litter. Costs of rescue operations involving the coastguard to vessels with fouled propellers in UK waters reached

[19] Losses are reported to amount €2.200/year/vessel, in 2010 prices (Mouat et al; 2010), corrected to €2340 in 2013 prices.

[20] http://ec.europa.eu/fisheries/fleet

[21] Vessels surveyed by KIMO (2010) spend an average of 41 hours a year removing marine litter from fishing gear. This is multiplied by an average EU27 labour cost of 23,4€ per hour.
(see : http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Hourly_labour_costs).

[22] 87.667 fishing vessels according to the EC - Fleet Register on the Net (2013) http://ec.europa.eu/fisheries/fleet/index.cfm?method=Search.ListSearchSimple

[23] In Mouat et al. (2010), the damage due to litter is budgeted at €180/year/vessel, based on data of Scottish fishing vessels (191 € actualized to 2013 prices).

[24] According to Member States DCF data submissions, the total amount of income generated by the EU fishing fleet in 2010 (excluding Greece) was €7 billion. This amount consisted of €6,6 billion in fish sales, €34 million in fishing rights rental income, €193 million in non-fishing income, and €126 million in direct income subsidies (JRC; 2012).

between €830.000 and €2.189.000 in 2008 (Mouat et al; 2010). The most frequently reported cause of fouled propellers was derelict fishing gear. However, no unit costs per ship could be deducted from literature. Several sources only give anecdotal evidence of the dangers of blocked propellers and other gear.[25] Thus, such costs are not accounted for in this model.

Total sectoral results

The **total quantified cost of degradation**, taking together the cost of beach cleaning and damage to fishing gear and vessels is estimated to **be between 250,9 m€ and 687 m€**. The **'best estimate' within this range is 469 m€**. Assuming marine litter inflow growth of 2.9% to 2030 under the full implementation scenario, and a linear relationship between marine litter and costs, **projected marine litter-related costs are 483 m€ in 2030** (2013 prices). This is compared with the projected 27,5% decrease of marine litter inflows (and associated costs) under scenario 3.4, whereby costs would fall to 340 m€ (2013 prices). This implies a **total saving of 143 m€ in marine-litter related costs by 2030**.

This is, however, a conservative estimate as it has not been possible to quantify impacts to all sectors and activities, including voluntary beach cleaning, cleaning of harbours and marinas, damage to non-fishing vessels, rescue call-out costs related to vessels damaged by marine litter or the cost of any health impacts from marine litter. In addition, the ecological value not directly related to money transfers, are not taken into account quantitatively.

[25] The economic study of Hall (2000) mentions "costly repairs, loss of time and danger to boaters and crews", but without exact calculations as most incidents are not reported.

ANNEX 10: SUMMARY OF THE MAIN MODEL UNCERTAINTIES

Collection

The model has, necessarily, to simplify somewhat the complexity of the situation which actually exists in MS. In each country, there are, and are likely to be in future, a range of different collection systems in place. The model simplifies reality by modelling a narrow range of systems. However, although the range is narrowed, the general tendencies are expected to be a reasonable reflection of the relative costs of systems delivering varying recycling rates.

The model makes assumptions which determine the number of households which can be served by a given vehicle. These are likely to vary from place to place. The model seeks to deal with this through setting different parameters for urban, suburban and rural households.

The costs are modelled in real terms. They are essentially deemed to remain constant across time in real terms. The time horizon for the assessment is, however, considerable. Over such a period, the index of some input parameters to the collection model, such as labour costs, might not be the same as the general rate of price increases. As such, the costs might not remain constant in real terms over the time period considered. This is, however, believed to be the most reasonable assumption to make in the circumstances (projecting, for example, the rate of increase in real wages would appear to be rather speculative);

The value of materials being captured for recycling is deemed to remain constant in real terms. Following a period in history (roughly spanning the period 1950-2000) over which real prices for commodities have experienced a secular decline, the last decade has seen that secular decline completely reversed owing to increased global demand, notably from China. Many commentators believe prices may continue to rise in real terms, but there are, equally reasons why prices, not least in real terms, may decline. As such, the assumption regarding constant prices in real terms seems reasonable.

For each country, where municipal waste is concerned, the model uses data from MS regarding the composition of their municipal waste. The composition data is of variable quality. Because of the variation in composition from one country to another, the revenue generated from the capture of recyclables varies across countries (affecting net costs).

Quite apart from current waste composition, the modelling effectively has to consider waste composition over the period to 2030-2035. Relatively little is known about exactly how waste composition will change in future. What seems certain, however, is that it will change. It is to be hoped that those changes that do occur will increase the extent to which materials can be easily recycled. What cannot be known, however, is how such changes will affect the costs of collecting and processing materials, and the revenues generated from selling the materials collected. The assumption of constant composition is on the one hand unlikely to reflect reality, but on the other, it is felt that no reasonable alternative assumption exists.

Treatment

The costs of treatment are assumed to remain constant in real terms. For some treatments, as well as taking into account the sale of some materials (see above) the net costs take into account the sales of energy. The revenue derived from the sales of energy are assumed to be constant in real terms. This implies constant real terms prices for energy. Energy prices could, of course, follow a different path;

The costs are influenced by assumptions regarding capital costs, assumed to be constant across countries, and the costs of other inputs to the process. Labour costs have been adapted to MS labour costs. There is variation in unit capital costs of facilities, but the model assumes a single figure for a given treatment type. This seems reasonable given that the high level, strategic nature of the model means that assumptions regarding the size of specific facilities cannot meaningfully be made;

The way in which capital costs are financed will affect the costs for different facilities. In different MS, there are different patterns of financing and ownership of waste management facilities. Some facilities are funded from savings made by municipalities, others are financed using public/private partnerships. These situations lead to a variety in the costs of capital, and this affects the costs of operating facilities. The model effectively assumes a single figure for the real costs of capital.

Externalities

The overall figures for externalities reflect the inclusion and exclusion of various effects in the model. Main externalities of well operated facilities are captured by the model, but even so, some externalities are not captured by the model (see Annex 6).

The model assumes different damage costs for the air pollutants with these adapted for each Member State. These are based on the best evidence available, but clearly, uncertainties exist;

The model assumes a profile for the damages associated with GHG emissions. The debate concerning how best to value damages associated with GHGs continues apace. There are clearly alternative assumptions that could be made in this regard;

Some characteristics of key processes influence emissions, and hence, externalities. Key amongst these are:

1. The modelling of the extent to which biodegradable material degrades in landfill;
2. The capture of methane generated by landfills for energy generation and flaring (and crucially, the amount of methane escaping to the atmosphere);
3. For technologies generating energy, such as incineration, the nature of the energy source which is assumed to be avoided, at the margin, when new facilities are introduced;
4. The modelled GHG emissions from facilities relate back to waste composition. If composition is not well known, then the emissions will be similarly poorly understood (and as noted above, composition is likely to change in future).

ANNEX 11: COMPARISON OF THE MAIN DEFINITIONS USED IN THE EU WASTE LEGISLATION

Definitions	Waste Framework Directive (WFD)	Packaging and Packaging waste Directive (PPWD)	Landfill Directive	Waste Statistic Regulation (Wstat R)
Prevention	Measures taken before a substance, material or product has become waste, that reduce: (a) the quantity of waste, including through the re-use of products or the extension of the life span of products; (b) the adverse impacts of the generated waste on the environment and human health; or (c) the content of harmful substances in materials and products	The reduction of the quantity and of the harmfulness for the environment of materials and substances contained in packaging and packaging waste, packaging and packaging waste at production process level and at the marketing, distribution, utilization and elimination stages, in particular by developing 'clean' products and technology		
Reuse	Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived **Preparing for reuse:** Checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing	Any operation by which packaging, which has been conceived and designed to accomplish within its life cycle a minimum number of trips or rotations, is refilled or used for the same purpose for which it was conceived, with or without the support of auxiliary products present on the market enabling the packaging to be refilled; such reused packaging will become packaging waste when no longer subject to reuse		
Recycling	Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations	The reprocessing in a production process of the waste materials for the original purpose of for other purposes including organic recycling but excluding energy recovery **Organic recycling:** Aerobic (composting) or anaerobic (biomethanization) treatment, under controlled conditions and using micro-organisms, of the biodegradable parts of packaging waste, which produces stabilised organic residues or methane		Same as PPWD Reporting is done on aggregation of the R-codes listed in Annex II to the WFD. It is not always clear which of these R – codes refer to recycling, or recovery

Recovery	Any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy. Annex II sets out a non-exhaustive list of recovery operations	Same as WFD **Energy recovery:** Use of combustible packaging waste as a means to generate energy through direct incineration with or without other waste but with recovery of the heat		Same as WFD The reporting is linked to the recovery codes listed in Annex II to the WFD, it is not always clear which of these R – codes refer to recycling, or recovery
Municipal waste	(not a definition as such in the Directive) Waste collected from private households, including where such collection also covers such waste from other producers		Waste from households as well as other waste which, because of its nature or composition is similar to waste from household	
Disposal	Any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy. Annex I sets out a non-exhaustive list of disposal operations;	Same as in the WFD	**Landfill**: a waste disposal site for the deposit of the waste onto or into land (i.e. underground)	Same as WFD and Landfill Directive (for Landfills) Reporting is done on aggregations of the D-codes listed in Annex I to the WFD
Biowaste	Biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises and comparable waste from food processing plants		**Biodegradable waste**: Any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and paperboard	
Treatment	Recovery or disposal operations, including preparation prior to recovery or disposal		Physical, thermal, chemical or biological processes, including sorting, that change the characteristics of the waste in order to reduce its volume or hazardous nature, facilitate its handling or enhance recovery	Reporting is done on aggregates of the R and D codes of the WFD

EUROPEAN
COMMISSION

Brussels, 2.7.2014
SWD(2014) 207 final

PART 4/6

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Proposal for a Directive of the European Parliament and of the Council

amending Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, 1999/31/EC on the landfill of waste, 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment

{COM(2014) 397 final}
{SWD(2014) 208 final}
{SWD(2014) 209 final}
{SWD(2014) 210 final}

Annex 4 – Detailed Results of the Consultation on the Review of European Waste Management Targets

Contents

1.0 Introduction

The Targets Review Project has been commissioned by DG Environment at the European Commission. The project is aimed at identifying the issues and proposing possible solutions to the targets in the Waste Framework Directive, the Landfill Directive and the Packaging and Packaging Waste Directive. The basis for the review of the targets is twofold: on the one hand it is to respond to the review clauses set out in the Directives and, on the other, to bring these targets in line with the Commission's ambitions of promoting resource efficiency and reducing greenhouse gas emissions.

This project is being delivered by Eunomia Research & Consulting (Eunomia) with support from Öko-Institut, the Copenhagen Resource Institute (CRI), ARGUS, and Satsuma Media. It is being delivered under Eunomia's contract with the European Commission on *"Technological, Socio-Economic and Cost-Benefit Assessments Related to the Implementation and Further Development of EU Waste Legislation"*.

This document presents the results of the consultation on the Review of European Waste Management Targets which was held between the 4th June and 9th September 2013. Responses to each of the questions have been analysed and have been broken down according to the different stakeholder groups. The methodological approach to the data analysis is summarised in **Section 2.0**. This is followed by a summary of the response rates to each section of the consultation in **Section 3.0**. Finally, the results are presented in **Section 4.0** to **Section** Error! Reference source not found., each of which deals with a different section of the consultation:

- **Section 4.0** – Waste Framework Directive;
- **Section 5.0** – Landfill Directive;
- **Section** Error! Reference source not found. – Packaging and Packaging Waste Directive;
- **Section** Error! Reference source not found. – Roadmap to a Resource Efficient Europe;
- **Section** Error! Reference source not found. – Targets as a Tool in Waste Legislation; and
- **Section** Error! Reference source not found. – Consultation questions for European Citizens.

It is important to note that this report does not provide an analysis of the options which will be carried forward for detailed analysis as part of the Commission's impact assessment. This work is being carried out in parallel to this and will be published in the near future.

2.0 Analysis of Results

The consultation questions were subdivided into the following seven sections (the full consultation can be found in Appendix A1.0):

- General questions;
- Waste Framework Directive;
- Landfill Directive;
- Packaging and Packaging Waste Directive;
- Roadmap to a Resource Efficient Europe;
- Targets as a tool in waste legislation; and
- Consultation for European citizens.

The majority of the questions within each section were voluntary and therefore respondents could choose to respond or not, depending on whether they had an opinion on a particular subject. The consultation included a number of closed- and open-ended questions to which stakeholders could respond to. The closed-ended questions were straightforward to analyse as the statistics are clearly presented in numerical form. In contrast, the analysis of the open-ended questions required significantly more effort. These questions were analysed by reading each of the responses and coding the key themes that emerged from these answers. Each time a new theme emerged it was added to the list. If themes emerged a number of times, as they frequently did, these were coded accordingly. We describe below how the different aspects of the consultation were analysed.

2.1 Stakeholder Groups

The consultation questions were developed in close association with the Commission who provided the final sign off of the document before it was published in the Commission's Interactive Policy Making (IPM) tool. The consultation sought to elicit views from the following stakeholder groups:

- Industry, not-for-profit, and academic organisations:
  - Industry trade bodies/organisations;
  - Industry representatives;
  - Not-for-profit/non-governmental organisations;
  - Academic institutions; and
  - Other organisations.
- Public authorities (e.g. Member States, regional or local competent authorities); and
- European Citizens.

In most cases the results of the consultation have been divided up to show the views of the different groups of stakeholders. This is of particular importance when considering the proposed suggestions for revising the targets as different stakeholders typically have alternative, and often conflicting views, of what the best approach will be.

2.2 Analysis of Closed-ended Questions

In order to facilitate analysis the consultation contained a number of closed-ended questions. Closed-ended questions were used to allow respondents to rank various options as part of a 'matrix' or choose alternative answers from a finite list of options. Some of the most important questions in the consultation consisted of the 'matrix' style questions in which respondents were asked to rank various – on a scale of 1 to 5 – options which were put forward as suggestions for revising the existing Directive targets. There are many ways in which these data can be analysed in order to determine which the most preferred options are. As part of the analyses which have been presented in this report we have chosen two alternative methods for depicting these results:

1. In order to enable the overall rank of each option to be compared we calculated the weighted average rank for all options presented in each 'matrix'; and
2. In order to ascertain the strength of the preference for or against certain options we also present the results of the difference between the number of respondents who ranked an option as 5 (i.e. very favourably) against the number who ranked it as 1 (i.e. an option not worth considering). The difference between the number of upper and lower rank responses provides a clearer means for illustrating strong differences in opinion, something which is not always clearly illustrated through a weighted average. In these figures the most favoured options are shown by a large number and options which were strongly disliked have low or even negative rankings.

It is believed that together these two sets of analyses provide a clear indication of which options may or may not be preferred (assuming there is a spread of opinion across options). Analysis of the remaining closed-ended questions was straight forward and, as shown in the results sections below, consisted of providing weighted averages and averages for different responses.

2.3 Analysis of Open-ended Questions

The majority of open ended questions in the consultation asked respondents to list additional issues and solutions which had not already been identified in the consultation. In a number of instances it was found that people had reiterated, albeit in different words, issues and/or solutions which had already been identified. In these instances responses were coded as 'Issue/solution already listed'. When asked to identify additional issues a number of respondents offered solutions instead of presenting issues specifically related to the targets. To prevent these solutions from being lost, these responses were added to the questions which asked whether any additional solutions could be suggested. These responses were coded as 'Response is a solution, not an issue'. Likewise, in cases where respondents were asked to propose additional solutions, but instead raised concerns about issues, the responses were coded as 'Response is an issue, not a solution'. Finally, in a number of cases stakeholders identified issues and solutions which were not related to the scope of work being

undertaken as part of the Review of Targets Project. These responses were coded as being 'non-target issues/solutions'.

All other responses were coded with the intention of identifying common themes. For each open-ended question, lists of coded responses were created based on the answers that were received.

3.0 Response Rates and Country Profiles

A total of 670 responses were received from various stakeholders across Europe. The number of responses from different groups of stakeholder can be seen in Table 3-1. This table also provides details on how many stakeholders from each group responded to the different sections of the consultation. For example, 136 industry trade bodies responded to the consultation, with 122 of these respondents choosing to answer questions under the Waste Framework Directive section of the consultation.

Table 3-1: Response Rates Broken Down by Stakeholder and Consultation Section

Consultation Section		All Stakeholders	Stakeholder Group						
			Industry Trade Bodies	Industry Representatives	Not-for-Profit Organisations	Academic Institutions	Other Organisations	Public Authorities	European Citizens
Total Number of Responses	***No.***	***670***	***136***	***80***	***54***	***6***	***20***	***49***	***325***
	%	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***
Waste Framework Directive	No.	371	122	73	50	5	18	47	56
	%	80%	90%	91%	93%	83%	90%	96%	48%
Landfill Directive	No.	313	102	57	42	3	16	47	46
	%	68%	75%	71%	78%	50%	80%	96%	39%
Packaging Waste Directive	No.	368	101	63	50	5	19	46	84
	%	80%	74%	79%	93%	83%	95%	94%	72%
Roadmap Section	No.	462	136	80	54	6	20	49	117
	%	69%	100%	100%	100%	100%	100%	100%	36%
Targets as a Tool in Waste Legislation	No.	394	116	61	48	3	18	41	107
	%	85%	85%	76%	89%	50%	90%	84%	91%
Citizen Consultation	No.	278	-	-	-	-	-	-	278
	%	86%	-	-	-	-	-	-	86%

Note: All percentages are given relative to the total number of responses received from each stakeholder

group.

Each group of stakeholders was asked to identify which country they were based in and the results of this are summarised in Table 3-2.

Table 3-2: Distribution of Countries in which Stakeholders are Based[1]

Country	Stakeholder Group													
	Industry Trade Bodies		Industry Representatives		Not-for-Profit Organisations		Academic Institutions		Other Organisations		Public Authorities		European Citizens	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Austria	3	2%	2	3%	3	6%	0	0%	2	10%	1	2%	3	1%
Belgium	54	40%	7	9%	8	15%	1	17%	3	15%	1	2%	21	6%
Bulgaria	0	0%	1	1%	1	2%	0	0%	0	0%	0	0%	2	1%
Cyprus	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	0%
Czech Republic	1	1%	1	1%	4	7%	0	0%	0	0%	0	0%	0	0%
Croatia	0	0%	0	0%	2	4%	0	0%	0	0%	1	2%	4	1%
Denmark	1	1%	4	5%	2	4%	0	0%	0	0%	1	2%	1	0%
Estonia	0	0%	0	0%	0	0%	0	0%	0	0%	2	4%	0	0%
Finland	3	2%	3	4%	1	2%	0	0%	0	0%	0	0%	1	0%
France	10	7%	11	14%	6	11%	1	17%	2	10%	2	4%	85	26%
Germany	10	7%	9	11%	10	19%	1	17%	3	15%	5	10%	73	22%
Greece	0	0%	2	3%	0	0%	0	0%	0	0%	0	0%	1	0%
Hungary	2	1%	0	0%	0	0%	0	0%	0	0%	0	0%	1	0%
Ireland	3	2%	0	0%	0	0%	0	0%	2	10%	1	2%	1	0%
Italy	6	4%	5	6%	0	0%	0	0%	2	10%	1	2%	56	17%
Latvia	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	0%
Lithuania	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	5	2%
Luxembourg	0	0%	0	0%	0	0%	0	0%	0	0%	1	2%	0	0%
Malta	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Netherlands	6	4%	7	9%	2	4%	1	17%	0	0%	3	6%	5	2%

Country	Stakeholder Group													
	Industry Trade Bodies		Industry Representatives		Not-for-Profit Organisations		Academic Institutions		Other Organisations		Public Authorities		European Citizens	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Poland	0	0%	1	1%	1	2%	0	0%	0	0%	1	2%	9	3%
Portugal	5	4%	3	4%	0	0%	1	17%	0	0%	1	2%	3	1%
Romania	1	1%	3	4%	2	4%	0	0%	0	0%	5	10%	7	2%
Slovakia	1	1%	0	0%	0	0%	0	0%	0	0%	0	0%	2	1%
Slovenia	0	0%	0	0%	1	2%	0	0%	0	0%	0	0%	1	0%
Spain	7	5%	1	1%	6	11%	0	0%	2	10%	6	12%	20	6%
Sweden	4	3%	2	3%	1	2%	0	0%	0	0%	3	6%	0	0%
United Kingdom	19	14%	11	14%	3	6%	1	17%	4	20%	12	24%	17	5%
Other	0	0%	7[2]	9%	1[3]	2%	0	0%	0	0%	2[4]	4%	5[5]	2%
Total	***136***	***100%***	***80***	***100%***	***54***	***100%***	***6***	***100%***	***20***	***100%***	***49***	***100%***	***325***	***100%***

Notes:

1. *In the case of industry multinational organisations respondents were asked to identify the country in which their head office was based. All percentages are given relative to the total number of responses received from each stakeholder group.*
2. *Six these stakeholders have their head offices in Switzerland and one in the USA.*
3. *This stakeholder was from Norway.*
4. *These two stakeholders were from Norway.*
5. *These citizens were all from Switzerland.*

4.0 Waste Framework Directive

As per the consultation this section is divided into two sections. The first presents a summary of the key issues that were identified by stakeholders that were not already identified within the consultation (see Appendix A1.0). The second looks at possible options for revising and/or improving the targets.

4.1 Key Issues

A number of issues were identified in the consultation and respondents were asked to succinctly list up to three additional issues that had not been listed in the consultation. As described in Section 2.0 these open ended responses were coded to identify common themes and allow the data to be subjected to more detailed analysis. The feedback on issues received by respondents was intended to provide additional context to the issues already identified in the consultation. In many instances stakeholders chose to provide solutions to problems instead of listing additional problems related to the existing targets that had not already been identified within the consultation. Some of the issues that were reported were also not directly related to the Waste Framework Directive targets or were repeats, albeit in different words, of the issues that had already been listed in the consultation. Some of the more commonly identified issues included the following:

- There are no separate targets for biowaste or other waste streams such as textiles;
- The obligation to have separate collections is not clearly defined and is not 'ambitious' enough;
- Targets focus too much on quantity of collected waste and not enough on the actual rates of reuse and/or recycling;
- The Waste Framework Directive does not distinguish well between different forms of recycling (e.g. closed- vs. open-loop recycling);
- The quality of the recyclate/final product is not taken into account in the existing targets;
- There is no harmonised definitions on treatment options (e.g. reuse, preparation for reuse, and recycling);
- There are no targets on waste prevention and/or reuse;
- There are no 'communication targets' to ensure effective sharing of information and to promote the required behaviour change;
- Statistical/data issues (e.g. poor quality data reporting/statistical analysis by some Member States);
- The weight based targets are inadequate as they do not account for differences in the environmental impacts of different materials;
- There are no recycling targets which cover commercial and industrial waste; and
- There are no strict penalties for failing to meeting the targets.

4.2 Suggestions for Revision

A number of suggested options for changes to the Waste Framework Directive were identified in the consultation. The following options were included in the consultation as part of a scoring matrix:

Targets on Municipal Waste, Article 11 (2) a

1. Establish a single target and calculation method based only on the quantity of *municipal* waste collected. This would require that a consistent definition of municipal waste is used in all Member States.
2. Extend the existing targets to include other specific waste streams beyond paper, metal, plastic and glass (for example, wood, food waste, textiles, and other materials in municipal waste).
3. Establish a single target and calculation method based only on the quantity of *household* waste collected. This would require that a consistent definition of household waste is used in all Member States.
4. Adjust the targets so that biowaste is also included.
5. Set targets which reflect environmental weightings for materials (for example, through reference to greenhouse gas savings achieved through recycling).
6. Improve monitoring and validation of the reports submitted by Member States so that the consistency and reliability of data can be validated.
7. Introduce requirements on businesses to sort a range of waste materials for recycling and composting / anaerobic digestion.

Construction & Demolition Waste Targets, Article 11 (2) b

8. The 70% recycling target should not include backfilling.
9. Provide clear definitions of recycling and material recovery, and how these should be calculated for the C&D waste stream.
10. Mandate sorting of wastes at C&D sites with a special attention to hazardous waste.
11. Require facilities which sort 'mixed' C&D wastes to achieve a high level of recycling of the input materials.

Respondents were asked to rank each of the above options on a scale of 1 to 5, where:

- 1 = poor idea, not worth consideration;
- 3 = moderately good idea, may be worth further consideration; and
- 5 = very good idea, definitely deserves further consideration.

The results of the responses to this question are presented for all stakeholders in Figure 4-1 and for each stakeholder group in Figure 4-2 to Figure 4-5. In each of these figures the 11 options represent those listed above and the reader should refer back to this list

in order to identify which options were most favoured by respondents. As described in Section 2.2 the results of this ranking exercise are presented in two ways:

1. As a weighted average rank; and
2. As the difference in the number of respondents who ranked an option as '5' vs. those who ranked it as '1'.

In the pages below each figure contains two graphs which present the results of the above two analyses.

Figure 4-1: Scoring of Options by all Stakeholders

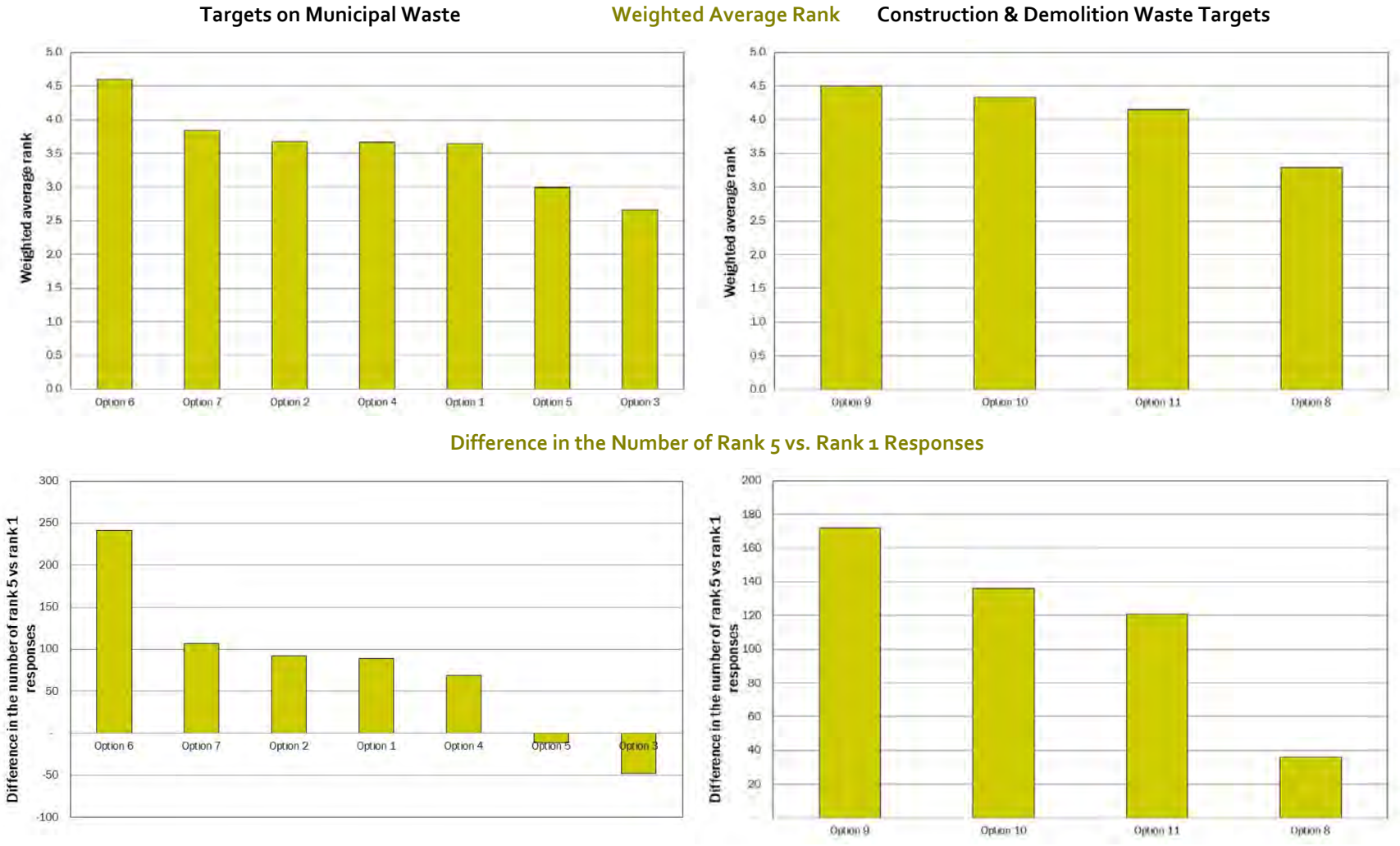
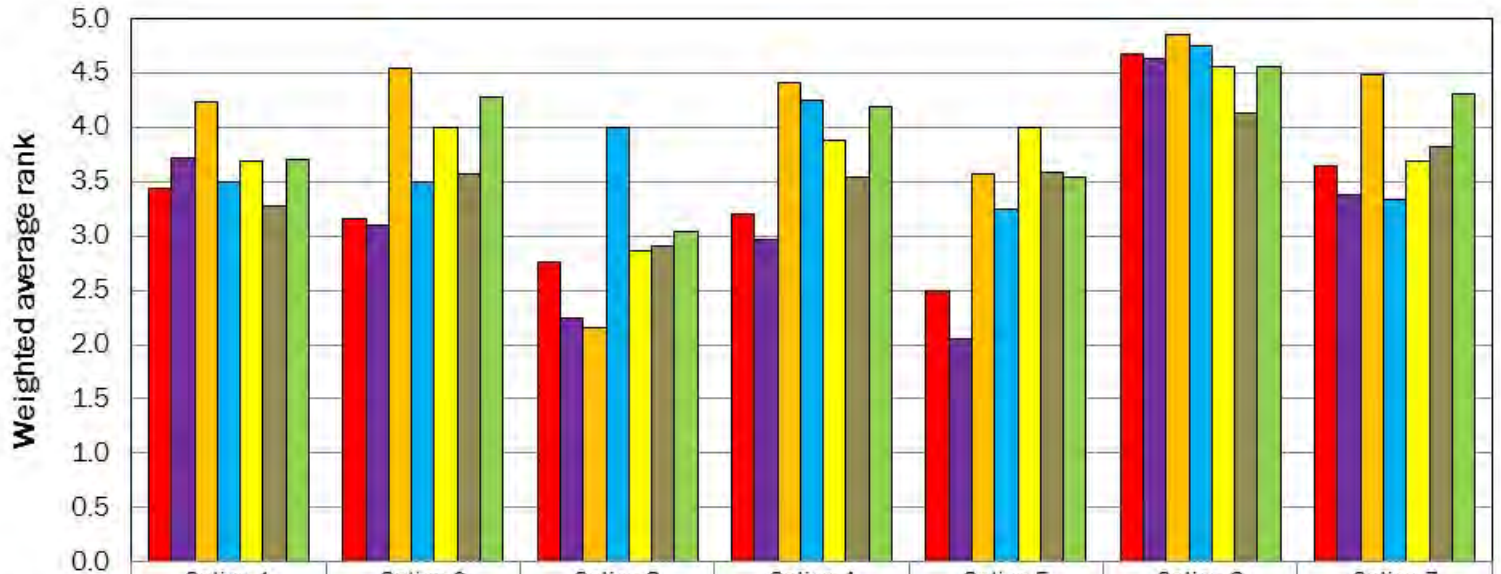
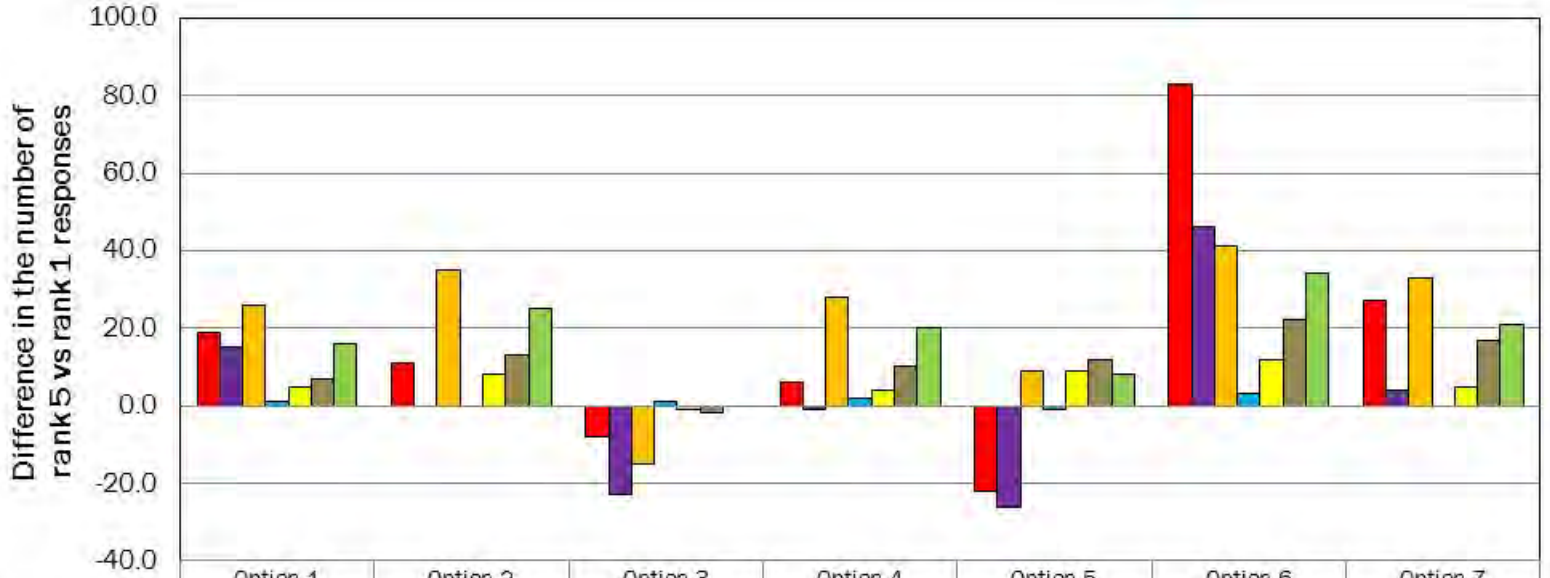


Figure 4-2: Scoring of Options by all Stakeholder Groups – Targets on Municipal Waste, Weighted Average Rank



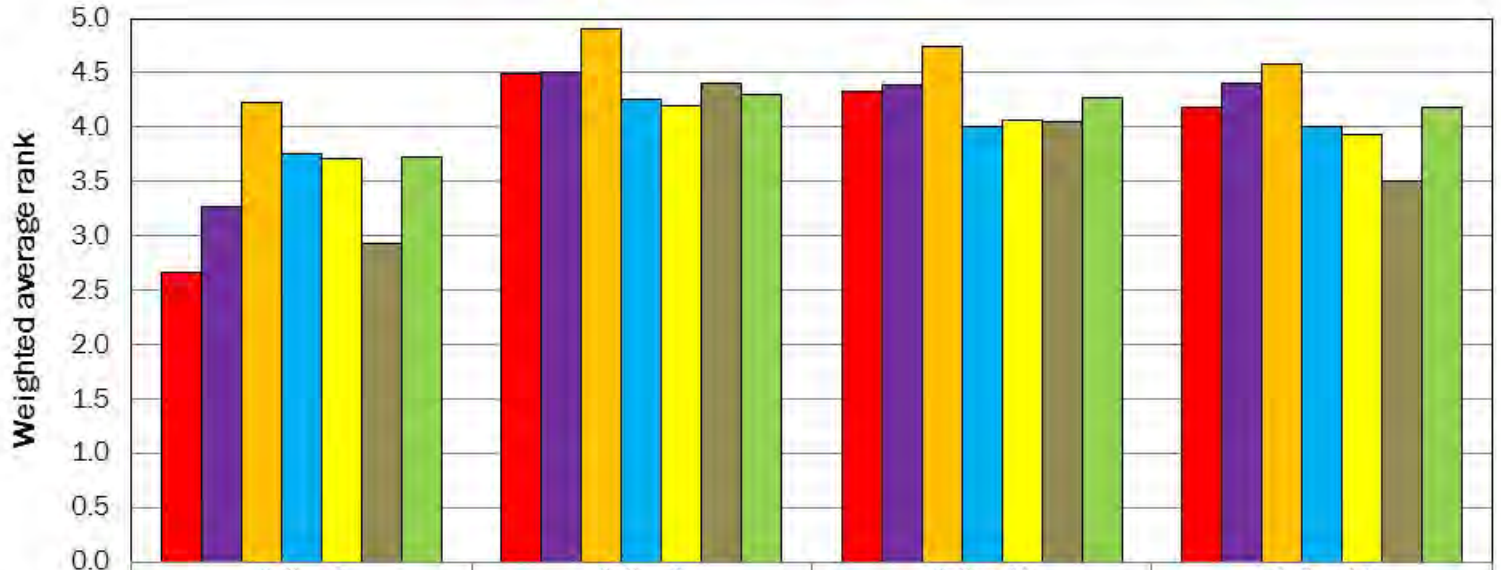
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Industry Trade Bodies	3.4	3.2	2.8	3.2	2.5	4.7	3.6
Industry Representatives	3.7	3.1	2.2	3.0	2.1	4.6	3.4
Not-for-Profit Organisations	4.2	4.5	2.2	4.4	3.6	4.9	4.5
Academic Institutions	3.5	3.5	4.0	4.3	3.3	4.8	3.3
Other Organisations	3.7	4.0	2.9	3.9	4.0	4.6	3.7
Public Authorities	3.3	3.6	2.9	3.5	3.6	4.1	3.8
European Citizens	3.7	4.3	3.0	4.2	3.5	4.6	4.3

Figure 4-3: Scoring of Options by all Stakeholder Groups – Targets on Municipal Waste, Rank 5 vs. Rank 1



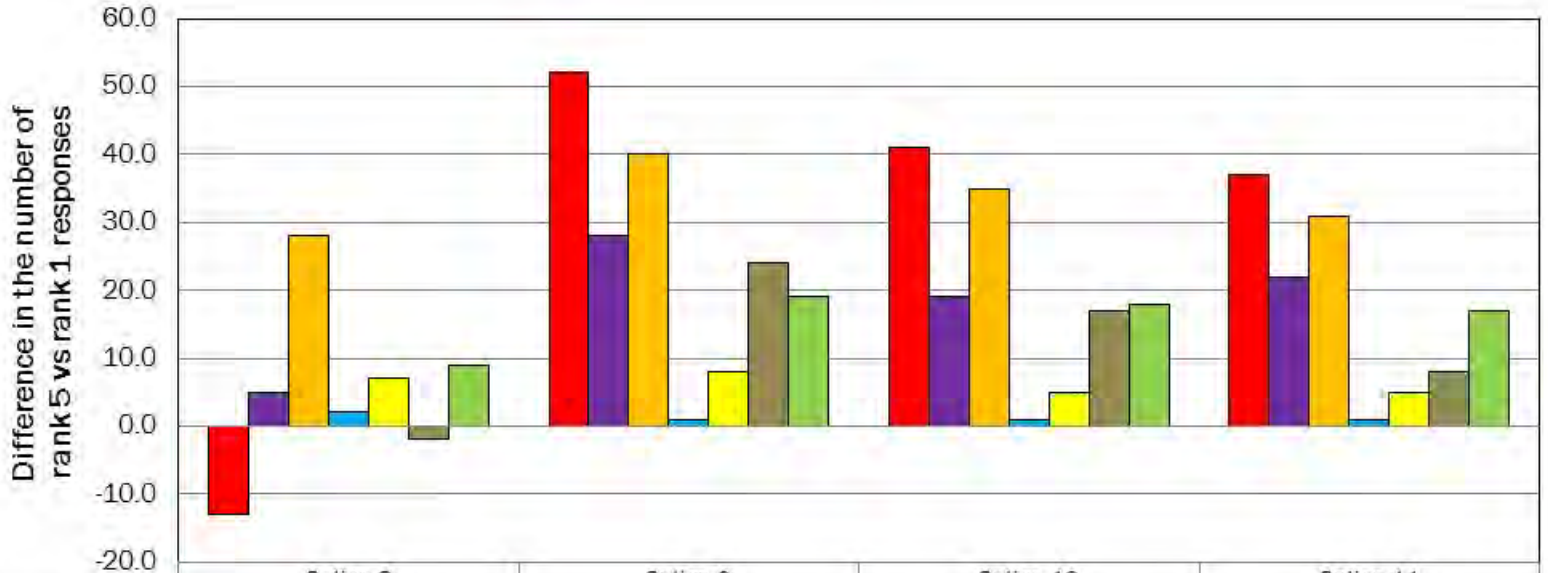
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Industry Trade Bodies	19	11	-8	6	-22	83	27
Industry Representatives	15	-	-23	-1	-26	46	4
Not-for-Profit Organisations	26	35	-15	28	9	41	33
Academic Institutions	1	-	1	2	-1	3	-
Other Organisations	5	8	-1	4	9	12	5
Public Authorities	7	13	-2	10	12	22	17
European Citizens	16	25	-	20	8	34	21

Figure 4-4: Scoring of Options by all Stakeholder Groups – Construction and Demolition Waste Targets, Weighted Average Rank



	Option 8	Option 9	Option 10	Option 11
Industry Trade Bodies	2.7	4.5	4.3	4.2
Industry Representatives	3.3	4.5	4.4	4.4
Not-for-Profit Organisations	4.2	4.9	4.8	4.6
Academic Institutions	3.8	4.3	4.0	4.0
Other Organisations	3.7	4.2	4.1	3.9
Public Authorities	2.9	4.4	4.0	3.5
European Citizens	3.7	4.3	4.3	4.2

Figure 4-5: Scoring of Options by all Stakeholder Groups – Construction and Demolition Waste Targets, Rank 5 vs. Rank 1



	Option 8	Option 9	Option 10	Option 11
Industry Trade Bodies	-13	52	41	37
Industry Representatives	5	28	19	22
Not-for-Profit Organisations	28	40	35	31
Academic Institutions	2	1	1	1
Other Organisations	7	8	5	5
Public Authorities	-2	24	17	8
European Citizens	9	19	18	17

In addition to the listed options which were scored as part of the closed-ended scoring matrix respondents were also asked to list solutions that they felt had not already been identified and should potentially be considered. These open-ended responses were coded to identify the different themes that emerged from these responses. The range of additional solutions that were suggested by all stakeholder groups are summarised in Table 4-1.

Table 4-1: Additional Suggestions for Revision Provided by All Stakeholder Groups

Solution	Number of Times Solution Identified by Respondents
Introduce waste prevention and/or reuse targets	27
Resource efficiency should be considered when setting targets	26
There should be a clear distinction between different types of recycling (e.g. closed-loop vs. open-loop)	25
C&D recycling targets should include backfilling under certain clearly defined conditions	23
Targets should encourage/mandate separate collections (of dry recyclables and/or food waste) and the issues of separate collections should be clearly resolved by the EC	21
Targets should be specified on a kg/capita basis and reduced over time	14
All organisation collecting and recycling waste should report on quantities received/processed, there should be better reporting of end destinations	13
Introduce recycling targets for commercial and/or industrial waste	12
Establish a separate recycling target for biowaste	9
Targets should incentivize local recycling rather than export to other EU countries or to outside the EU	8
A better legislative definition of backfilling is required	7
Targets for each material should be based on lifecycle assessment of environmental impacts	7
Establish a specific target for hazardous waste	6
Waste management at C&D sites should be more highly regulated (e.g. the requirement for Site Waste Management Plans in the UK)	5
Ensure that existing targets are properly implemented	5
Clarify all definitions in the legislation	5
Extend producer responsibility legislation to other products/materials	5
Introduce penalties for Member States who fail to meet the targets	3
Targets should be equal or nearly equal across all Member States	3
Better enforcement of the targets is required	3
Targets should not mandate source segregation of recycling	3
Targets should focus on the quality as well as quantity of recycled materials	3
Introduce qualitative targets where technical specifications of raw materials are compared against secondary materials	3
Target should be calculated on total waste arisings, not just municipal waste	2
The targets should be more ambitious	2
Put in place financial incentives to move waste to the top of the hierarchy	2

Solution	Number of Times Solution Identified by Respondents
Targets should be based on waste generated rather than waste collected as waste can be 'lost' from the system in the form of litter etc.	2
Consider different targets for each member state which reflect the large variation in waste management across the EU	2
Biowaste should not be included in the targets	2
Source separation of hazardous wastes should be mandatory	2
C&D recycling target should be more ambitious	2
After 2020 set separate targets for household and municipal waste	2
For C&D recycling target set individual/tailored improvement targets based on current performance of Member States	2
Create targets to ensure recyclability of products and minimum resource use during manufacture	1
Make the public advertisement of waste performance obligatory for local authorities	1
Integrate the Packaging Waste Directive into the Waste Framework Directive	1
Materials which can more easily/cost effectively be recycled should have higher targets	1
Define the materials that can be included in backfilling	1
Promote segregation of C&D waste	1
High-efficiency energy recovery should be included in the targets	1
Remove the exclusion of hazardous waste from the calculation method for the target of C&D waste.	1
It is important to have a target for backfilling	1
Waste streams should be based on European Waste Catalogue (EWC) codes	1
The 70% material recovery target for C&D waste should only include recycling of other fractions than aggregate	1
There is a need for harmonization of the provisions of the Waste Framework Directive when they are transposed in Member States	1
Do not extend targets to include other specific waste streams beyond paper, metal, plastic and glass	1
Implement a residual waste target to drive waste prevention	1
New targets to include other specific waste materials should be made at a local, rather than at EU, level.	1
New targets should be set even if not all states have reached existing targets	1
Weight is a more reliable and effective measure than environmental impact	1
Packaging of construction materials should be incorporated into C&D targets	1
NGOs and industry associations should play a role in the monitoring and validation of the reports	1
Waste targets should be calculated using parameters that are captured by Eurostat already	1
C&D targets should not be set	1
There may need to be some flexibility in the targets to allow for market forces	1
An impact assessment should be carried out to look into the effects of including backfilling in the targets	1
Dismantling, sorting and collection of different types of C&D waste should be mandatory	1
The C&D target should be adjusted if it is to exclude backfilling	1

Solution	Number of Times Solution Identified by Respondents
Implementation of targets should be left to member states	1
Define targets for each of the three steps of the recycling value chain: collection, preparation recovery and final recovery	1
The C&D recycling target should, under certain circumstances, include incineration	1
Develop a Biowaste Directive	1
Set waste prevention target for C&I waste	1
Set targets for 'critical materials'	1
Use alternative instruments (e.g. taxes, charges, voluntary agreements) to achieve objectives	1
SMEs below a certain size should not be obliged to segregate their waste	1
Non-target solution	192
Response was a comment on proposed solutions / Solution was already listed in the consultation	76
Response is an issue, not a solution	9

5.0 Landfill Directive

As per the consultation this section is divided into two sections. The first presents a summary of the key issues that were identified by stakeholders that were not already identified within the consultation (see Appendix A1.0). The second looks at possible options for revising and/or improving the targets.

5.1 Key Issues

A number of issues were identified in the consultation and respondents were asked to succinctly list up to three additional issues that had not been listed in the consultation. As described in Section 2.0 these open ended responses were coded to identify common themes and allow the data to be subjected to more detailed analysis. The feedback on issues received by respondents was intended to provide additional context to the issues already identified in the consultation. In many instances stakeholders chose to provide solutions to problems instead of listing additional problems related to the existing targets that had not already been identified within the consultation. Some of the issues that were reported were also not directly related to the Landfill Directive targets or were repeats, albeit in different words, of the issues that had already been listed in the consultation. Some of the more commonly identified issues included the following:

- The current targets are only for biodegradable municipal waste rather than other waste streams;
- There has been a cack of enforcement and implementation of the Landfill Directive in many Member States;
- Inconstant methodologies have been used to report on the targets and landfill statistics under the Landfill Directive;
- A lack of recycling infrastructure in some Member States means that they are unlikely to be able to meet the targets; and
- The Landfill Directive is not strongly linked to current European Commission thinking on resource efficiency and the implementation of the waste hierarchy.

5.2 Suggestions for Revision

A number of suggested options for changes to the Directive targets were identified in the consultation. The following options were included in the consultation as part of a scoring matrix:

1. Revise the targets so that they are set in such a way that they do not penalise countries whose economies are growing faster after starting from a lower base.
2. Establish a legal obligation for reporting on 'municipal waste' and enforcing the use of a single definition of the term by all Member States.
3. Standardise the approach to performance measurement and progress reporting.
4. In Member States where no data exists for 1995, a more recent baseline year should be set with targets adjusted accordingly.
5. Clarify when treated waste should be considered 'no longer biodegradable' from

the perspective of the Landfill Directive.

6. Further tighten existing targets (e.g. move progressively towards zero biodegradable municipal waste sent to landfill).
7. Progressively include *all biodegradable* wastes (not just biodegradable wastes of municipal origin) within targets similar to the existing ones.
8. Introduce targets for the progressive reduction in the quantity of residual waste irrespective of how it is subsequently managed (whether it is sent to incineration, MBT or landfill, or any other residual waste management method).
9. Define 'pre-treatment' in an unambiguous manner so that the ban on landfilling waste that is not pre-treated is applied equally across all countries.

Respondents were asked to rank each of the above options on a scale of 1 to 5, where:

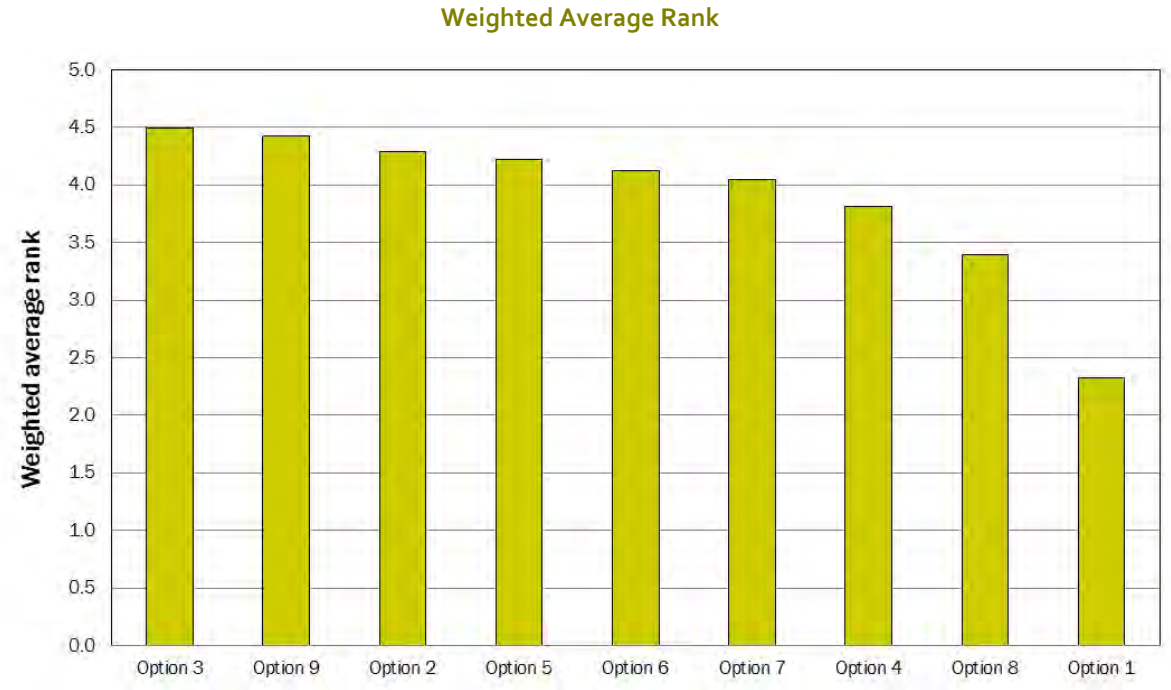
- 1 = poor idea, not worth consideration;
- 3 = moderately good idea, may be worth further consideration; and
- 5 = very good idea, definitely deserves further consideration.

The results of the responses to this question are presented for all stakeholders in Figure 5-1 and for each stakeholder group in Figure 5-2 and Figure 5-3. In each of these figures the 9 options represent those listed above and the reader should refer back to this list in order to identify which options were most favoured by respondents. As described in Section 2.2 the results of this ranking exercise are presented in two ways in the figures below:

1. As a weighted average rank; and
2. As the difference in the number of respondents who ranked an option as '5' vs. those who ranked it as '1'.

In the pages below each figure contains two graphs which present the results of the above two analyses.

Figure 5-1: Scoring of Options by all Stakeholders



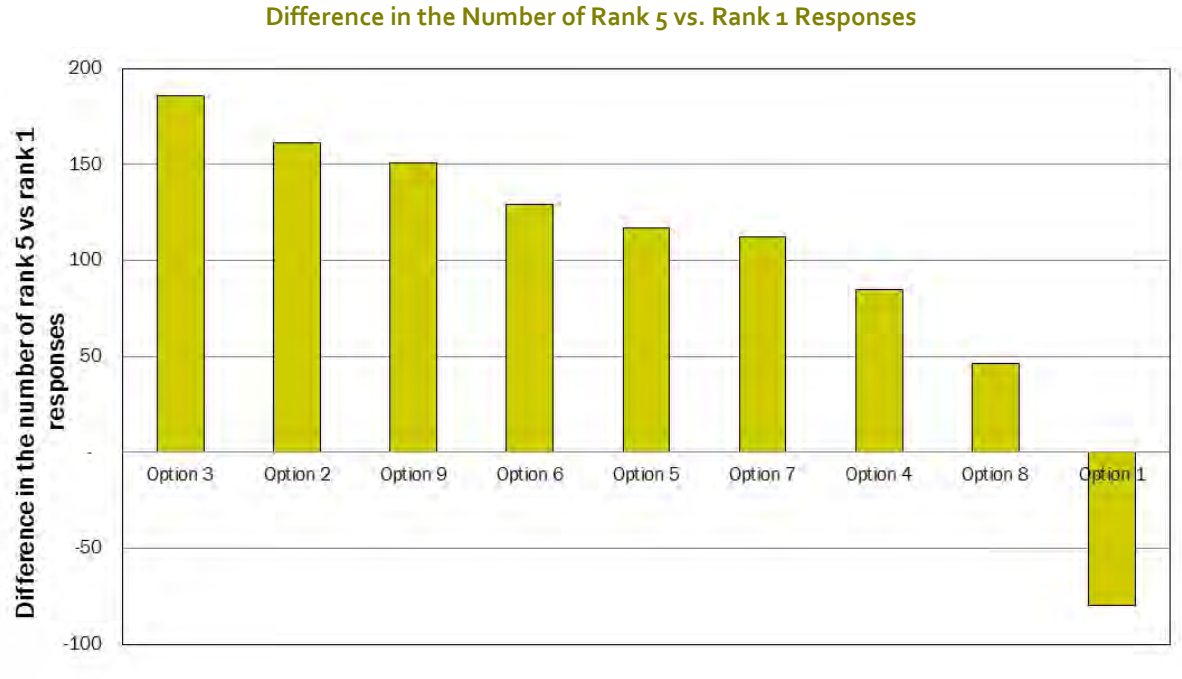
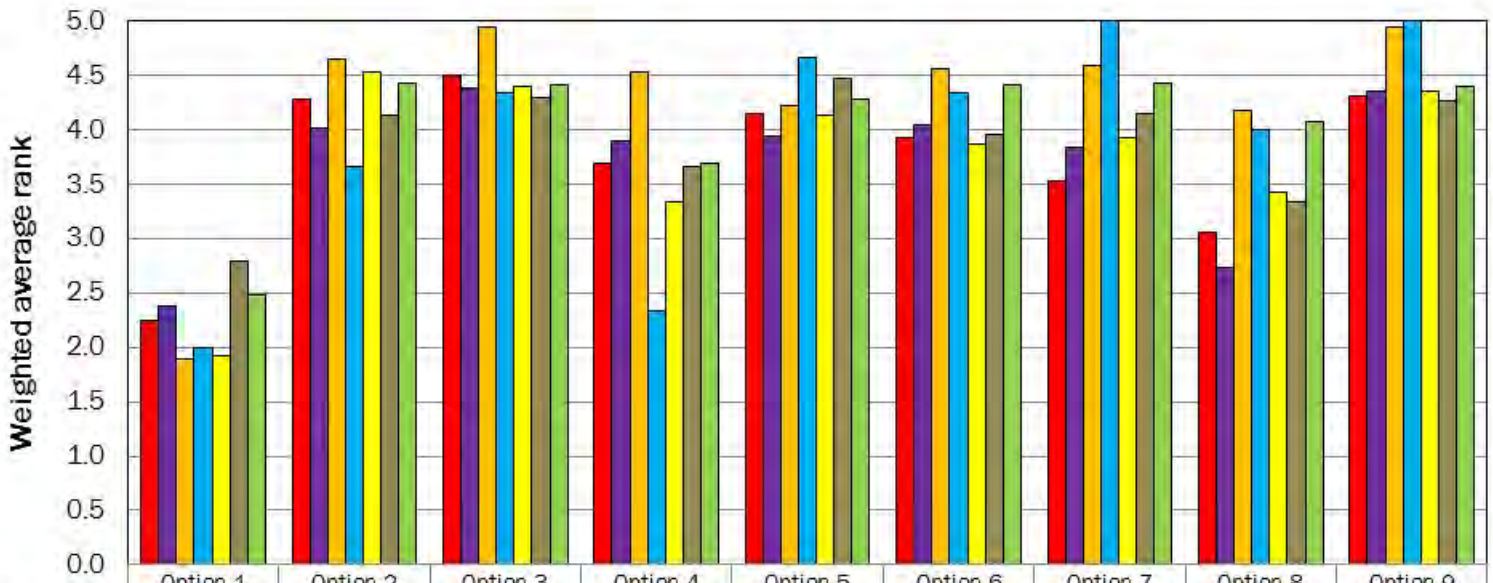
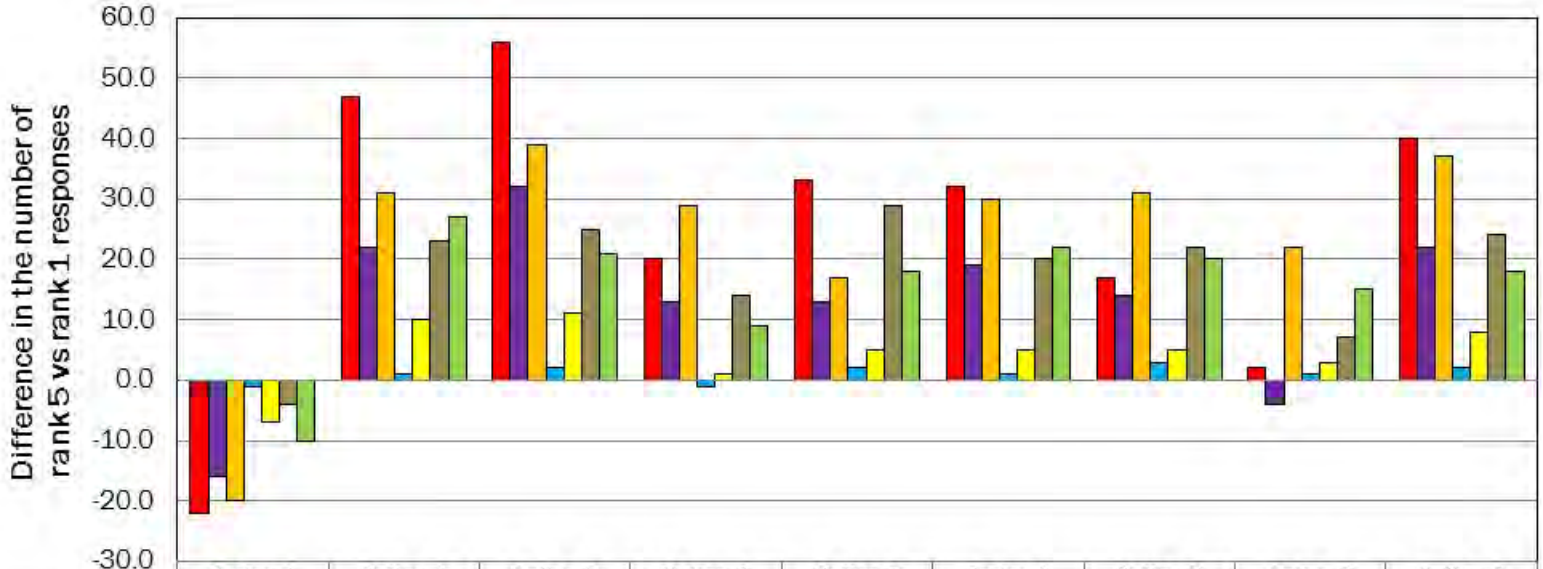


Figure 5-2: Scoring of Options by all Stakeholder Groups, Weighted Average Rank



	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9
Industry Trade Bodies	2.3	4.3	4.5	3.7	4.2	3.9	3.5	3.1	4.3
Industry Representatives	2.4	4.0	4.4	3.9	3.9	4.1	3.8	2.7	4.4
Not-for-Profit Organisations	1.9	4.7	5.0	4.5	4.2	4.6	4.6	4.2	4.9
Academic Institutions	2.0	3.7	4.3	2.3	4.7	4.3	5.0	4.0	5.0
Other Organisations	1.9	4.5	4.4	3.3	4.1	3.9	3.9	3.4	4.4
Public Authorities	2.8	4.1	4.3	3.7	4.5	4.0	4.2	3.3	4.3
European Citizens	2.5	4.4	4.4	3.7	4.3	4.4	4.4	4.1	4.4

Figure 5-3: Scoring of Options by all Stakeholder Groups, Rank 5 vs. Rank 1



	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9
Industry Trade Bodies	-22	47	56	20	33	32	17	2	40
Industry Representatives	-16	22	32	13	13	19	14	-4	22
Not-for-Profit Organisations	-20	31	39	29	17	30	31	22	37
Academic Institutions	-1	1	2	-1	2	1	3	1	2
Other Organisations	-7	10	11	1	5	5	5	3	8
Public Authorities	-4	23	25	14	29	20	22	7	24
European Citizens	-10	27	21	9	18	22	20	15	18

In addition to the listed options which were scored as part of the closed-ended scoring matrix respondents were also asked to list any additional solutions that they felt had not already been identified and should potentially be considered. These open-ended responses were coded to identify the different themes that emerged from these responses. The additional solutions that were suggested by all stakeholder groups are presented in Table 5-1 below.

Table 5-1: Additional Suggestions for Revision Provided by Stakeholders

Solution	Number of Times Solution Identified by Respondents
Introduce landfill bans for recyclable and/or combustible materials	36
Residual waste reduction targets should be specified (e.g. reduction in kg per capita per year) with suitable (i.e. environmentally sound and cost effective) alternatives treatment/recycling options are in place	28
Member states should be financially rewarded for legislation which moves waste up the hierarchy	22
Include more material streams in landfill diversion targets	18
Residual waste reduction targets should be set in the WFD not in the Landfill Directive	17
Progressive introduction of landfill bans on untreated waste	16
Adopt the legal framework as devised by the German Landfill Ordinance which excludes the disposal of plastic waste in bulk in landfills	13
No landfill bans unless feasible alternatives can be identified i.e. landfilling is not simply replaced by incineration	12
Introduce a mandatory landfill tax	10
Introduce landfill bans for biowaste	6
Provide support to member states regarding infrastructure investments	4
Stricter enforcement of the targets/Directive is required	4
Levels of targets should be informed by environmental impact assessments	4
Ensure all EU funding supports the waste hierarchy	4
Countries starting from a low base should have the same targets but a longer time to achieve them	2
There should not be an outright ban on landfill - some level of landfilling will always be required	2
Specific diversion rules should be developed for different materials	2
Penalise Member States who exaggerated their statistics for 1995	1
Implement landfill bans for specific materials and/or waste streams	1
Gradual introduction of landfill and incineration bans with suitable (i.e. environmentally sound and cost effective) alternatives treatment/recycling options are in place	1
Targets should be variable depending on waste produced per person and balanced against economic performance	1
There should be a stronger link to EC resource efficiency policy	1
More guidance required from EU on recommended treatment methods	1
There should be two different targets for biodegradable wastes, one for household waste and one for commercial waste.	1
Baseline years and deadlines to reach the targets should be the same for all Member States	1

Solution	Number of Times Solution Identified by Respondents
Member States whose data is estimated or highly inconsistent should have a more recent baseline year with targets adjusted accordingly	1
If member states are far from achieving targets, setting more ambitious targets may not be effective	1
There should be an updated baseline year for all Member States to ensure a level playing field	1
The first priority should be to avoid illegal and uncontrolled landfill sites	1
Targets should be set for household and industrial waste instead of municipal waste.	1
The choice of measurement methodology is to be kept at national level bearing in mind the need to achieve comparability at the EU-level	1
Member State which landfill more than X% of its waste should be required to agree an Action Plan of national measures to reduce the amount of waste sent to landfill	1
Alternatives to targets should be considered, such as economic instruments etc.	1
Replace percentage targets with a single target setting maximum amount of landfilled biodegradable waste of any origin in kg per capita	1
Move towards a maximum level of landfilling for all waste of X% per year	1
Post-consumer wood materials should be diverted from landfill	1
Non-target related solution proposed by stakeholder	70
Response was a comment on proposed solutions / Solution was already listed in the consultation	50
Response is an issue, not a solution	2

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PART 5/6

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Proposal for a Directive of the European Parliament and of the Council

amending Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, 1999/31/EC on the landfill of waste, 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment

{COM(2014) 397 final}
{SWD(2014) 208 final}
{SWD(2014) 209 final}
{SWD(2014) 210 final}

Contents

1.0 Packaging and Packaging Waste Directive

As per the consultation this section is divided into two sections. The first presents a summary of the key issues that were identified by stakeholders that were not already identified within the consultation (see Appendix A1.0). The second looks at possible options for revising and/or improving the targets.

1.1 Key Issues

A number of issues were identified in the consultation and respondents were asked to succinctly list up to three additional issues that had not been listed in the consultation. As described in Section **Error! Reference source not found.** these open ended responses were coded to identify common themes and allow the data to be subjected to more detailed analysis. The feedback on issues received by respondents was intended to provide additional context to the issues already identified in the consultation. In many instances stakeholders chose to provide solutions to problems instead of listing additional problems related to the existing targets that had not already been identified within the consultation. Some of the issues that were reported were also not directly related to the Packaging Waste Directive targets or were repeats, albeit in different words, of the issues that had already been listed in the consultation. Some of the more commonly identified issues included the following:

- Packaging Waste Directive does not include any targets for beverage and food cartons made of composite materials;
- The weight based targets do not reflect the environmental impacts associated with recycling different materials (e.g. glass vs. aluminium);
- There are no waste prevention or preparation for reuse targets in the Directive; and
- The targets are not ambitious enough and could be extended for some materials.

1.2 Suggestions for Revision

A number of suggested options for changes to the Directive targets were identified in the consultation. The following options were included in the consultation as part of a scoring matrix:

1. The methodology for calculating recycling rates should be standardised so that data (and hence performance levels) are comparable across Member States.
2. Remove from the Packaging Directive the target for packaging waste from municipal sources and include it into the Waste Framework Directive to ensure full consistency with the existing target on municipal waste recycling.
3. Bring the recycling targets for different materials closer together to ensure a more level playing field.
4. Incorporate "weightings" for materials recycled based on environmental benefits derived from recycling the material.
5. The targets for some packaging materials could be subdivided into subcategories; for example, metals could be divided into non-ferrous and ferrous metals. The same could apply for plastic; for example, separate targets could be set for PET,

LDPE, and HDPE.

6. Set specific targets for recycling of packaging waste from households to encourage further recycling of household packaging.
7. Remove from the Directive the maximum limit of 80% that stipulates how much packaging waste a Member State is allowed to recycle.
8. Introduce a target for prevention of packaging waste (the development of waste prevention targets is covered in a broader manner in a later section of this consultation).
9. Adjust the definitions for reuse and recycling in the Packaging Directive to be consistent with those contained in the Waste Framework Directive.
10. Expand the recycling target to include reuse, by allowing the reuse of packaging to be credited to the recycling target.
11. Introduce targets for reuse for commercial transit packaging.
12. Introduce targets for reuse for all packaging.

Respondents were asked to rank each of the above options on a scale of 1 to 5, where:

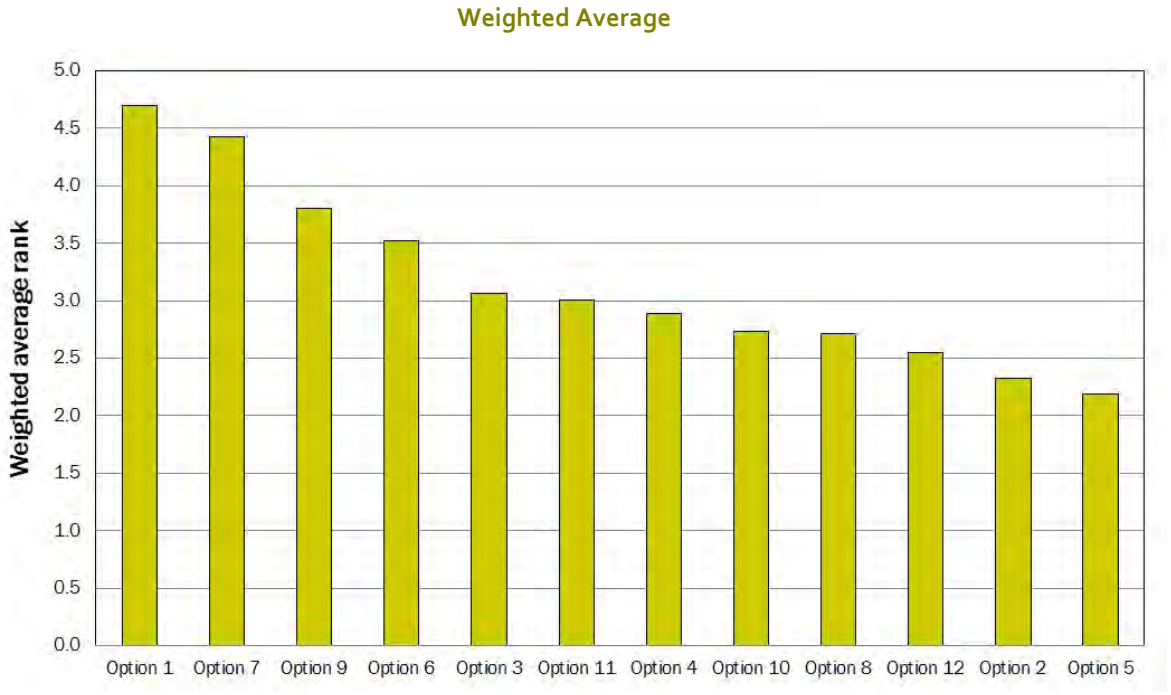
- 1 = poor idea, not worth consideration;
- 3 = moderately good idea, may be worth further consideration; and
- 5 = very good idea, definitely deserves further consideration.

The results of the responses to this question are presented for all stakeholders in Figure 1-1 and for each stakeholder group in Figure 1-2 and Figure 1-3. In each of these figures the 12 options represent those listed above and the reader should refer back to this list in order to identify which options were most favoured by respondents. As described in Section **Error! Reference source not found.** the results of this ranking exercise are presented in two ways:

1. As a weighted average rank; and
2. As the difference in the number of respondents who ranked an option as '5' vs. those who ranked it as '1'.

In the pages below each figure contains two graphs which present the results of the above two analyses.

Figure 1-1: Scoring of Options by all Stakeholders



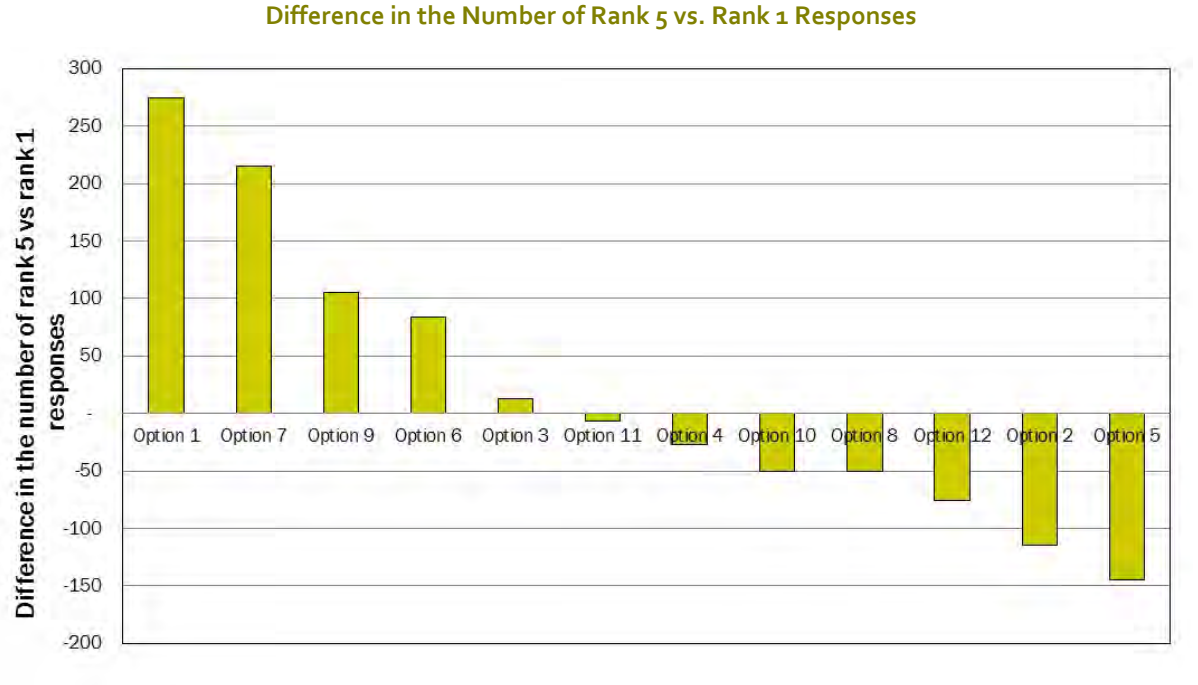
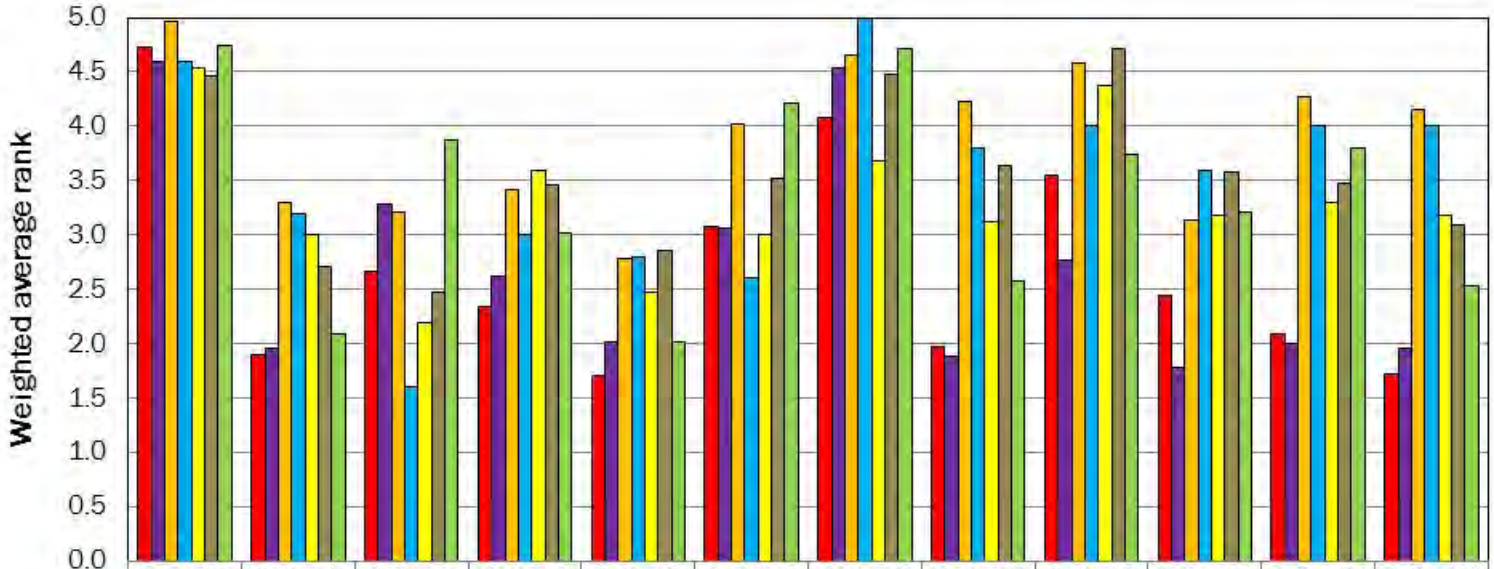


Figure 1-2: Scoring of Options by all Stakeholder Groups, Weighted Average Rank



	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11	Option 12
Industry Trade Bodies	4.7	1.9	2.7	2.3	1.7	3.1	4.1	2.0	3.5	2.4	2.1	1.7
Industry Representatives	4.6	2.0	3.3	2.6	2.0	3.1	4.5	1.9	2.8	1.8	2.0	2.0
Not-for-Profit Organisations	5.0	3.3	3.2	3.4	2.8	4.0	4.7	4.2	4.6	3.1	4.3	4.2
Academic Institutions	4.6	3.2	1.6	3.0	2.8	2.6	5.0	3.8	4.0	3.6	4.0	4.0
Other Organisations	4.5	3.0	2.2	3.6	2.5	3.0	3.7	3.1	4.4	3.2	3.3	3.2
Public Authorities	4.5	2.7	2.5	3.5	2.9	3.5	4.5	3.6	4.7	3.6	3.5	3.1
European Citizens	4.7	2.1	3.9	3.0	2.0	4.2	4.7	2.6	3.7	3.2	3.8	2.5

Figure 1-3: Scoring of Options by all Stakeholder Groups, Rank 5 vs. Rank 1

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11	Option 12
Industry Trade Bodies	75	-48	-13	-29	-57	6	43	-43	20	-31	-36	-56
Industry Representatives	46	-31	8	-11	-26	1	40	-28	-7	-35	-22	-30
Not-for-Profit Organisations	45	9	1	7	-11	21	36	27	36	5	26	24
Academic Institutions	4	-	-4	-1	-1	-	5	1	2	2	2	2
Other Organisations	12	-2	-4	6	-5	1	3	-	8	1	4	4
Public Authorities	29	-6	-8	7	-6	8	29	11	33	9	7	2
European Citizens	64	-37	33	-6	-39	47	59	-18	13	-1	12	-22

In addition to the listed options which were scored as part of the closed-ended scoring matrix respondents were also asked to list any additional solutions that they felt had not already been identified and should potentially be considered. These open-ended responses were coded to identify the different themes that emerged from these responses. The range of additional solutions that were suggested by all stakeholders are presented in Table 1-1.

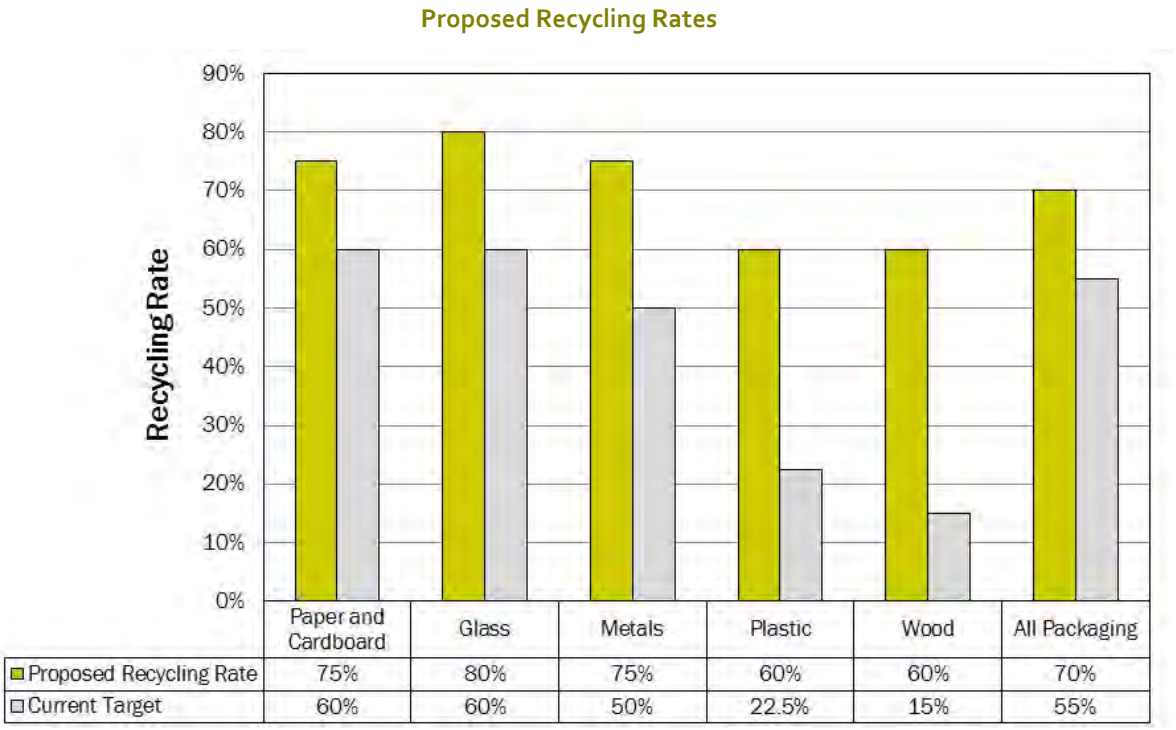
Table 1-1: Additional Suggestions for Revision Provided by Stakeholders

Solution	Number of Times Solution Identified by Respondents
Introduce a 60% minimum target per member state for each packaging material by 2020	42
A prevention target for packaging should not be considered (e.g. because packaging helps to prevent food waste, issues with health and safety)	27
Different types of recycling should be differentiated in the directive (e.g. closed- vs. open-loop recycling)	27
Introduce an incremental ban on the landfilling and/or incineration of packaging waste	24
The use of Extended Producer Responsibility, Eco-design, and other fiscal instruments should be extended/enhanced	23
Target should set minimum levels for use of recycled materials in packaging	22
Make source segregation of packaging materials mandatory	20
Place greater emphasis on the European CEN standards	19
Resource efficiency/environmental impacts should be the most important consideration when setting targets	17
Set targets to limit the use of packaging that cannot easily be recycled	13
Targets for reusable packaging should be the same for all materials and apply across all Member States	9
The recycling target should be based on the actual amount of material that is reprocessed and not on what is collected	6
Packaging manufacturers who use recycled materials in their products should be incentivised by having reduced recycling obligations	5
The rates achieved in the best performing Member States should serve as a target for all other Member States	4
Introduce targets for deposit refund schemes for certain packaging materials	4
Impacts on quality must be taken into account when setting targets	4
Introduce requirements to report on the end destinations of packaging waste	3
Targets should consider biodegradable plastic packaging	3
Set separate targets for ferrous and non-ferrous metals	3
Set separate targets for secondary and tertiary packaging	3
Reported recycling rates for exported materials should reflect the actual % of material recycled rather than the amount exported	2
Introduce one single target comprising reuse, recycling and recovery of packaging waste	2
Using life cycle analysis to determine targets for different materials is not cost effective	2
Better regulation of the output and operation of MRFs (e.g. the MRF Code of Practice introduced in the UK)	2

There is no need to bring the recycling targets for different materials closer together	1
Material treated/recycled outside of the EU28 should not count towards the targets	1
Remove the recovery targets from the Directive	1
Introduce consistent minimum thresholds for companies that have no reporting/recycling obligations	1
Remove the target for recycling wood packaging from Directive	1
Targets for packaging should be separate from the target contained in the WFD	1
Introduce a 'front runner' scheme whereby packaging standards are set by the best performing manufacturer	1
Introduce more ambitious targets	1
Targets should be simplified and differentiated by material	1
Response was a comment on proposed solutions / Solution was already listed in the consultation	139
Non-target related solution	89
Stakeholder response was an issue, not a solution	3

The Commission is keen to encourage higher rates of recycling. It recognises, however, the need to maintain the quality of recycled material so that it can be used profitably and with losses kept to a minimum between the collection and recycling stages. Keeping in mind the need to maintain quality, respondents were asked what they believed the highest level of recycling could reasonably be for the materials included in the current targets. The weighted average recycling rate for the different materials, and the proposed year in which stakeholders believed the reported recycling rates could realistically be achieved, are presented for all stakeholders in Figure 1-4 and for each stakeholder group in Figure 1-5 and Figure 1-6.

Figure 1-4: Weighted Average Recycling Rate Reported by all Stakeholders and Year in Which Proposed Recycling Rate May be Achieved



	Paper and Cardboard	Glass	Metals	Plastic	Wood	All Packaging
Proposed Recycling Rate	75%	80%	75%	60%	60%	70%
Current Target	60%	60%	50%	22.5%	15%	55%

Year in Which Proposed Recycling Rate Could be Achieved

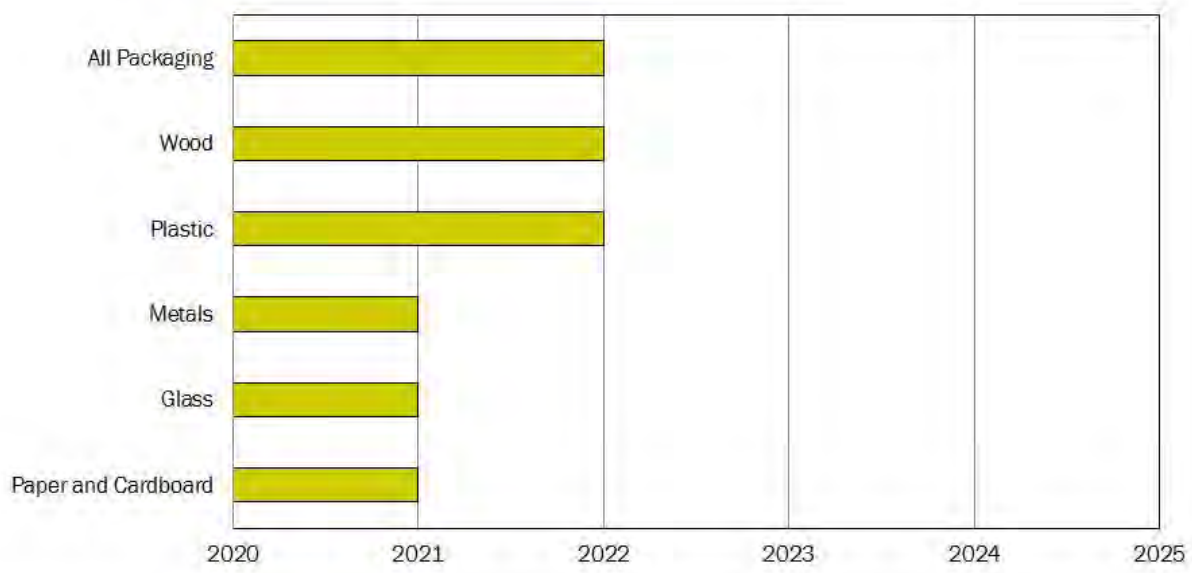
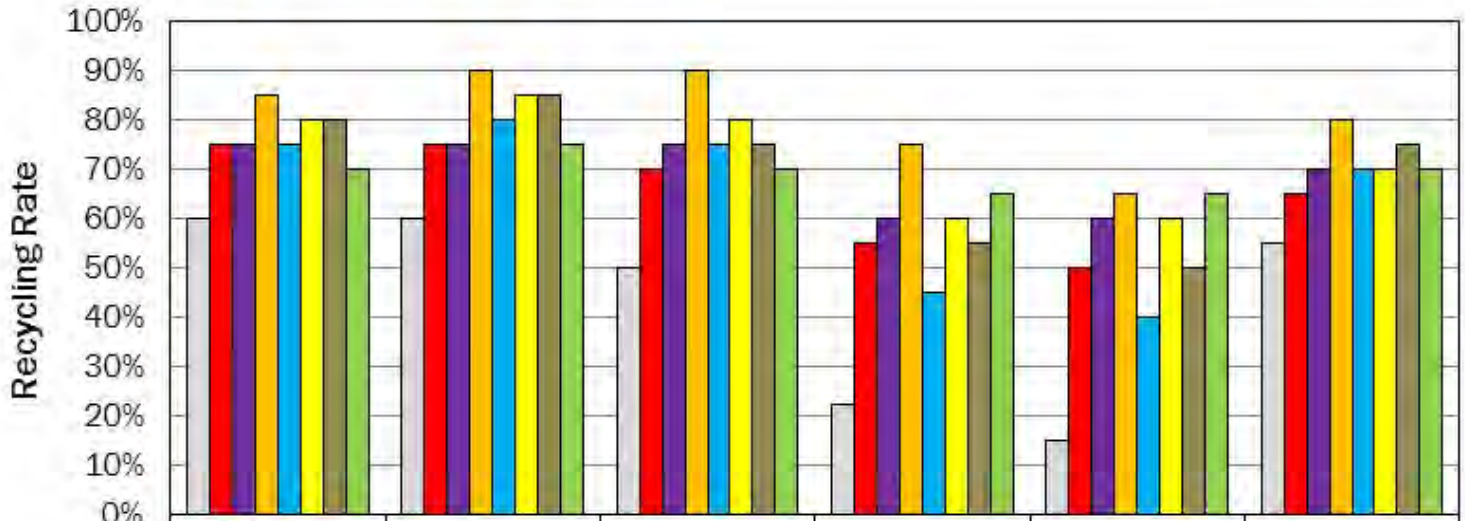
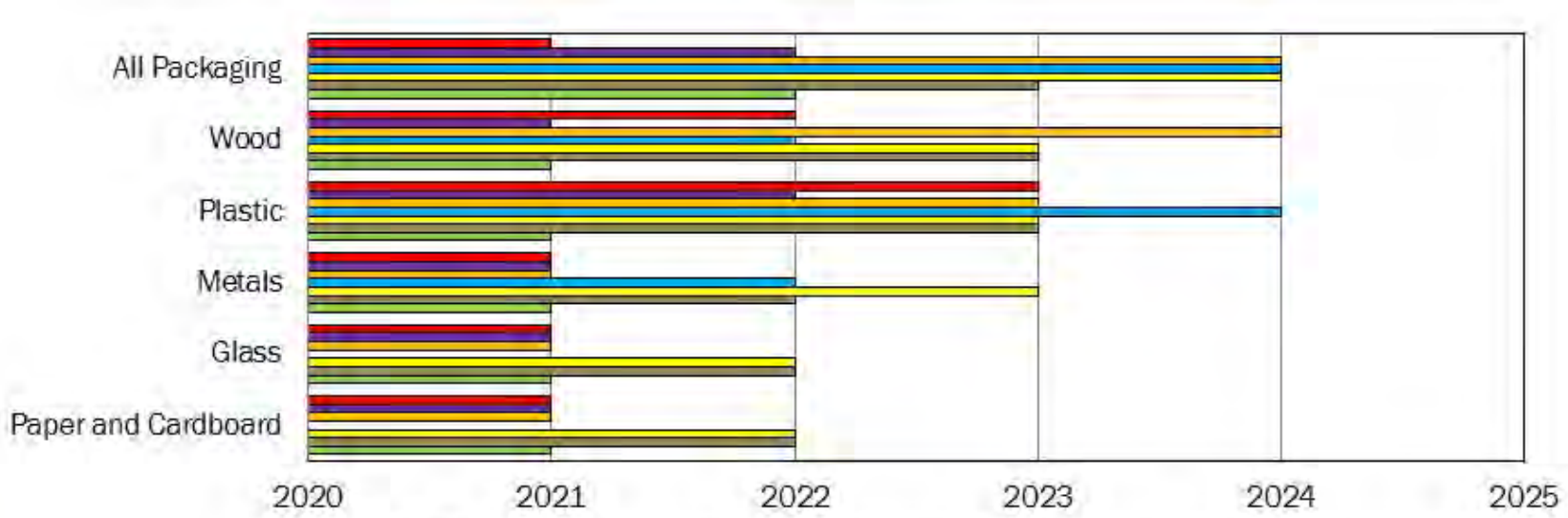


Figure 1-5: Weighted Average Recycling Rate Reported by all Stakeholder Groups



	Paper and Cardboard	Glass	Metals	Plastic	Wood	All Packaging
Current Target	60%	60%	50%	22.5%	15%	55%
Industry Trade Bodies	75%	75%	70%	55%	50%	65%
Industry Representatives	75%	75%	75%	60%	60%	70%
Not-for-Profit Organisations	85%	90%	90%	75%	65%	80%
Academic Institutions	75%	80%	75%	45%	40%	70%
Other Organisations	80%	85%	80%	60%	60%	70%
Public Authorities	80%	85%	75%	55%	50%	75%
European Citizens	70%	75%	70%	65%	65%	70%

Figure 1-6: Year in which Proposed Recycling Rate Could be Achieved Reported by all Stakeholder Groups



	Paper and Cardboard	Glass	Metals	Plastic	Wood	All Packaging
Industry Trade Bodies	2021	2021	2021	2023	2022	2021
Industry Representatives	2021	2021	2021	2022	2021	2022
Not-for-Profit Organisations	2021	2021	2021	2023	2024	2024
Academic Institutions	2020	2020	2022	2024	2022	2024
Other Organisations	2022	2022	2023	2023	2023	2024
Public Authorities	2022	2022	2022	2023	2023	2023
European Citizens	2021	2021	2021	2021	2021	2022

In addition to the materials already included in the existing targets, stakeholders were asked to identify further packaging materials which they believed should be include in any revised version of the target. The range of additional materials suggested is summarised for the main stakeholder groups in Table 1-2.

Table 1-2: Packaging Materials that could be Included in New Targets

Packaging Material	Number of Times Material Identified
Industry, Not-for-Profit, Academic and Other Organisations	
Composite packaging (e.g. beverage cartons)	28
Polystyrene and/or similar type of protective material	17
Textiles	7
Glass	1
Plastics	1
Aluminium cans	1
Beverage cans	1
Non-ferrous metal	1
Bio-plastics	1
Public Authorities	
Composite packaging (e.g. beverage cartons)	7
Polystyrene and/or similar type of protective material	1
Non-ferrous metal	1
Textiles	1
European Citizens	
Composite packaging (e.g. beverage cartons)	6
Textiles	5
Glass	1
Polystyrene and/or similar type of protective material	1
Non-ferrous metal	1
PET	1

2.0 Roadmap to a Resource Efficient Europe

In order to contribute to the development of resource efficiency within Europe the Commission has adopted aspirational targets for waste prevention and management in the Roadmap to a Resource Efficient Europe (the Roadmap).[1] These aspirational targets were proposed in the Commission's proposal for a 7th Environmental Action Plan.[2] In the Roadmap, the following aspirations are included within the overall Milestone for 2020:

1. Waste generated per capita is in absolute decline;
2. More materials, including materials having a significant impact on the environment and critical raw materials, are recycled;
3. Reuse and recycling are economically attractive options, with more material recycled and high quality recycling ensured;
4. Energy recovery is limited to non-recyclable materials (compostable materials are also considered to be recyclable); and
5. Landfilling is virtually eliminated.

This section of the consultation included questions on the application of the Roadmap on Resource Efficiency and its relation to the evolution of the main targets contained in legislation. We present here how respondents felt that the ambitions of the Roadmap should be implemented through the setting of targets in the context of this work.

2.1 Waste Prevention

The first question of this section asked respondents whether they agreed with the principle that there should be targets for waste prevention. Responses to this question are summarised in Table 2-1. Those stakeholders who responded that they felt that there should be no waste prevention targets were automatically directed to the next section of the consultation (see Section 1.1). The results presented below therefore come from those respondents who felt that the setting of new waste prevention targets would be a good idea.

[1] European Commission (2011) *Roadmap to a Resource Efficient Europe*, COM(2011) 571 final, http://ec.europa.eu/environment/resource_efficiency/about/roadmap/index_en.htm

[2] See Communication from the Commission to the European Parliament and the Council (2012) Decision of the European Parliament and of the Council on a General Union Environment Action Programme to 2020 "Living Well, Within the Limits of our Planet", COM(2012) 710 final, http://ec.europa.eu/environment/newprg/pdf/7EAP_Proposal/en.pdf

Table 2-1: Should the Commission Set New Waste Prevention Targets?

Answer		All Stakeholders	Stakeholder Group						
			Industry Trade Bodies	Industry Representatives	Not-for-Profit Organisations	Academic Institutions	Other Organisations	Public Authorities	European Citizens
Yes	No.	256	57	35	42	4	12	41	65
	%	55%	42%	44%	78%	67%	60%	84%	56%
No	No.	206	79	45	12	2	8	8	52
	%	45%	58%	56%	22%	33%	40%	16%	44%
Total	***No.***	***462***	***136***	***80***	***54***	***6***	***20***	***49***	***117***
	%	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

Respondents in favour of waste prevention targets were asked which waste streams, materials, or products they thought should be targeted (respondents were allowed to identify up to four items). The range of materials identified by each of the three main stakeholder groups is presented in Table 2-2.

Table 2-2: List of Waste Streams, Materials or Products that could be the Focus of Waste Prevention Targets

Industry, Not-for-Profit, Academic and Other Organisations		Public Authorities		European Citizens	
Waste Streams/Materials/Products	**No. of Responses**	**Waste Streams/Materials/Products**	**No. of Responses**	**Waste Streams/Materials/Products**	**No. of Responses**
Hazardous waste	28	Food	11	Packaging	5
"Total" waste	20	WEEE	7	Hazardous waste	4
Residual waste	16	Packaging	6	Biowastes	4
Industrial waste	15	Biowastes	5	Plastics	4
Food	12	Textiles	5	Metals	3
Biowastes	11	Metals	5	Industrial waste	2
Plastics	11	Plastics	5	WEEE	2
Packaging	11	Composite materials	4	Batteries	2
Metals	8	Municipal waste	3	Aluminium cans	2
Composite materials	8	Industrial waste	3	Plastic bottles	2
Municipal waste	7	"Total" waste	3	"Total" waste	2
Household waste	5	Household waste	2	Residual waste	2
WEEE	5	C&D waste	2	Composite materials	2
C&D waste	4	Hazardous waste	2	Commercial waste	1
Commercial waste	3	Commercial waste	1	C&D waste	1
Textiles	3	Paper / Cardboard	1	Paper / Cardboard	1
Plastic packaging film	2	Glass	1	Textiles	1
Plastic packaging	2	Furniture	1	Food	1
Medicines and healthcare waste	3	Garden	1	Non-packaging paper	1
Batteries and/or accumulators	1	Plastic bottles	1	Other scrap metal	1
Composites	1	Other rigid plastic packaging	1	Non-packaging rigid plastics	1
Garden	1	Residual waste	1	Plastic packaging film	1

Industry, Not-for-Profit, Academic and Other Organisations		Public Authorities		European Citizens	
Waste Streams/Materials/Products	**No. of Responses**	**Waste Streams/Materials/Products**	**No. of Responses**	**Waste Streams/Materials/Products**	**No. of Responses**
Non-packaging paper	1	Single use carrier bags	1	Furniture	1
Other rigid plastic packaging	1	Paint	1	Household oil	1
Inert materials	1			Tyres	1
Critical materials	1			Pesticides	1
Beverage bottles and cans	1				
Asphalt	1				

Respondents were asked to rank a number of options for the introduction of waste prevention targets. As in other sections of the consultation this ranking was on a scale of 1 to 5, where:

- 1 = poor idea, not worth consideration;
- 3 = moderately good idea, may be worth further consideration; and
- 5 = very good idea, definitely deserves further consideration.

The five options that were put forward were:

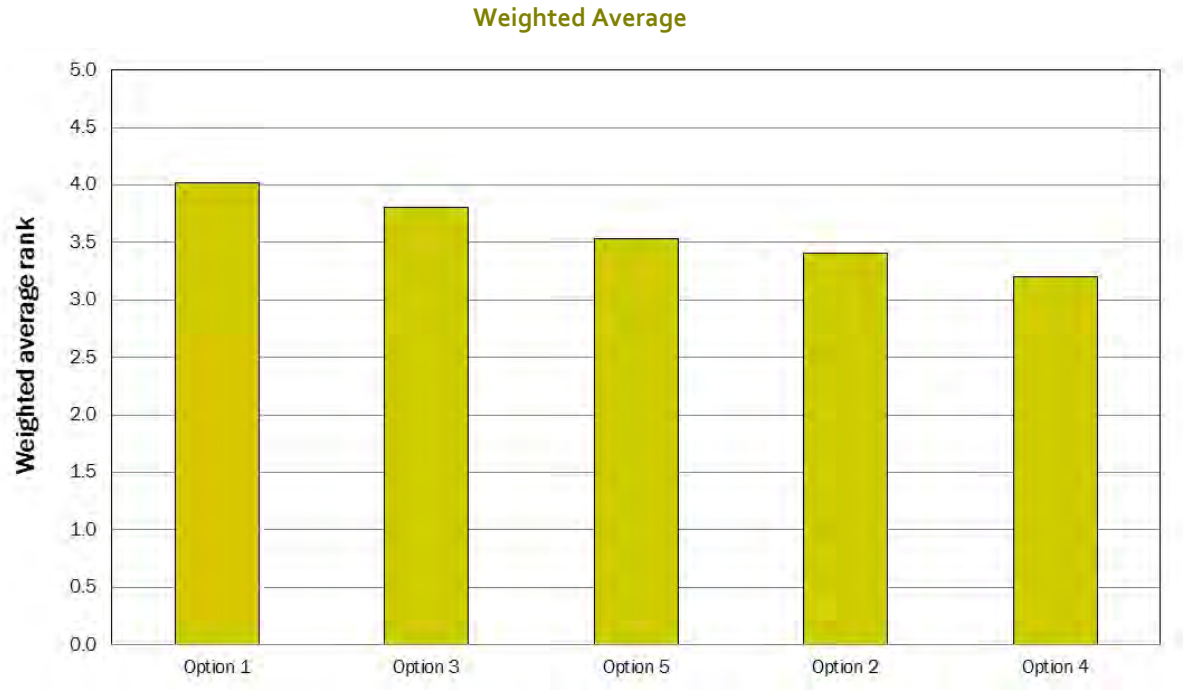
1. In line with the proposal in the Roadmap, a requirement that waste generated per capita is in decline by 2020.
2. Targets for decoupling of municipal waste from economic growth in line with Article 9(c) of the Waste Framework Directive. For example, the difference between the annual change in municipal waste per capita (X%) and the annual change in GDP per capita (Y%) should demonstrate a decoupling tendency such that over comparable (e.g. four year) periods, the value of (Y – X) is increasing in value.
3. Consistent reporting of household waste arisings across Member States would act to produce a level playing field for setting absolute targets on waste prevention (e.g. no greater than X kg per household per year). The targets could exhibit a declining trend over time.
4. New requirements could be set on Member States to incrementally increase the number of prevention measures in place and the overall coverage of these measures. For example, the number of households who have signed up to say "no" to unwanted mail, or the number of households covered by measures to reduce food wastage.
5. Introduce requirements for progressive coverage of households by pay-as-you throw schemes.

The results of the responses to this question are presented for all stakeholders in Figure 2-1 and for each stakeholder group in Figure 2-2 and Figure 2-3. In each of these figures the 5 options represent those listed above and the reader should refer back to this list in order to identify which options were most favoured by respondents. As described in Section **Error! Reference source not found.** the results of this ranking exercise are presented in two ways:

1. As a weighted average rank; and
2. As the difference in the number of respondents who ranked an option as '5' vs. those who ranked it as '1'.

In the pages below each figure contains two graphs which present the results of the above two analyses.

Figure 2-1: Scoring of Options by all Stakeholders



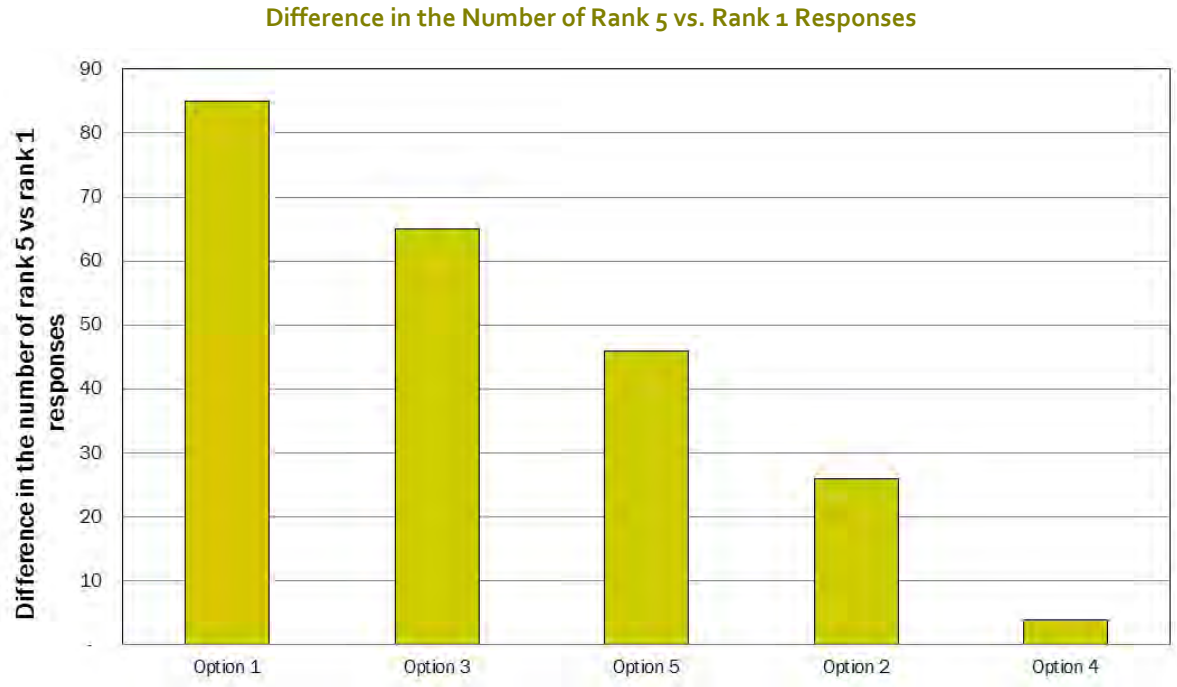
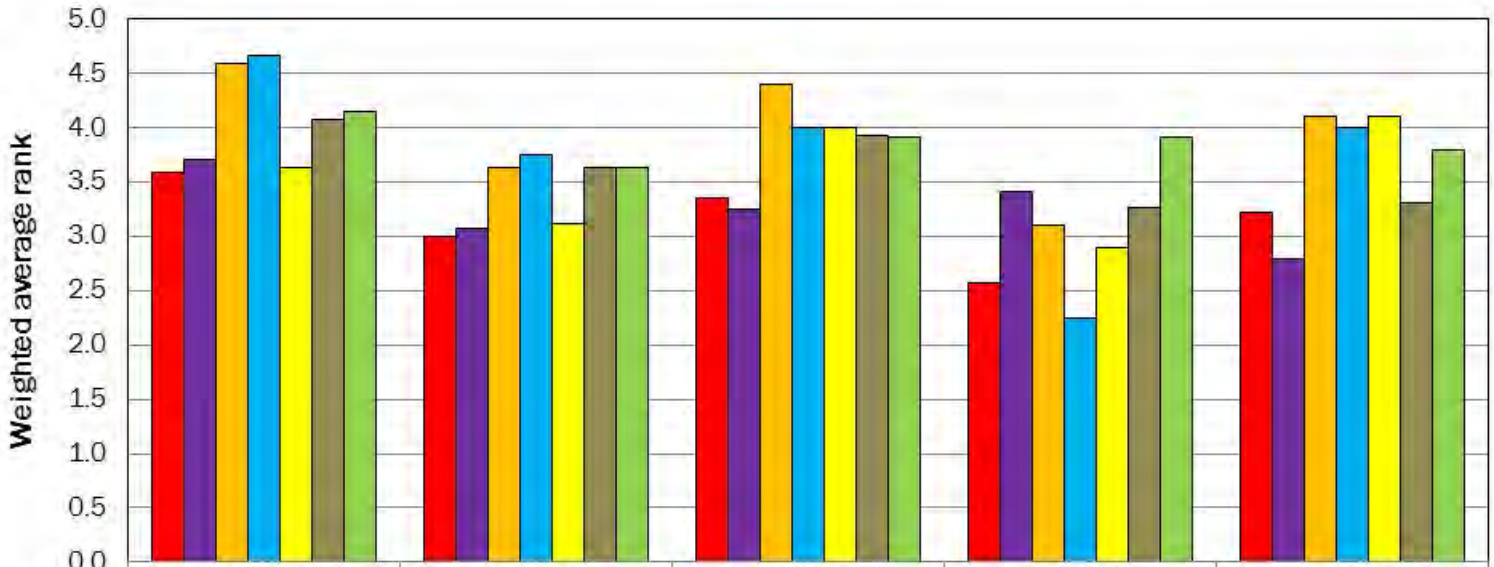
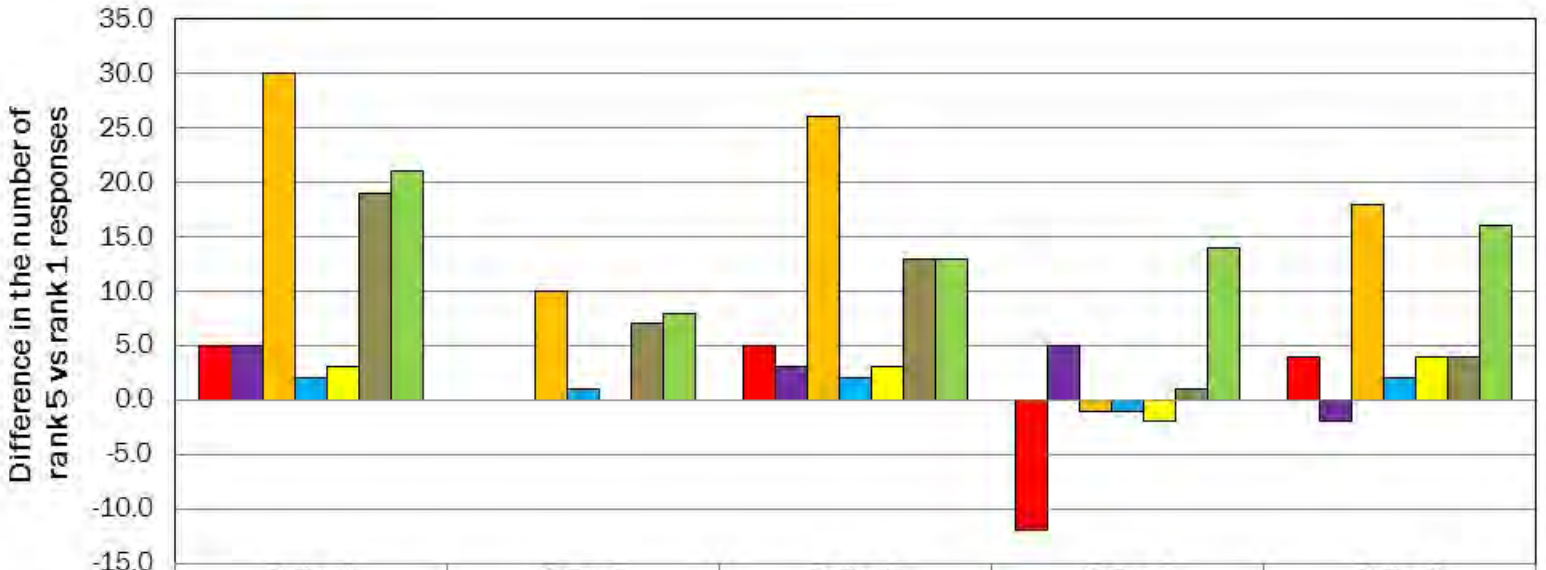


Figure 2-2: Scoring of Options by all Stakeholder Groups, Weighted Average Rank



	Option 1	Option 2	Option 3	Option 4	Option 5
Industry Trade Bodies	3.6	3.0	3.4	2.6	3.2
Industry Representatives	3.7	3.1	3.2	3.4	2.8
Not-for-Profit Organisations	4.6	3.6	4.4	3.1	4.1
Academic Institutions	4.7	3.8	4.0	2.3	4.0
Other Organisations	3.6	3.1	4.0	2.9	4.1
Public Authorities	4.1	3.6	3.9	3.3	3.3
European Citizens	4.1	3.6	3.9	3.9	3.8

Figure 2-3: Scoring of Options by all Stakeholder Groups, Rank 5 vs. Rank 1



	Option 1	Option 2	Option 3	Option 4	Option 5
Industry Trade Bodies	5	-	5	-12	4
Industry Representatives	5	-	3	5	-2
Not-for-Profit Organisations	30	10	26	-1	18
Academic Institutions	2	1	2	-1	2
Other Organisations	3	-	3	-2	4
Public Authorities	19	7	13	1	4
European Citizens	21	8	13	14	16

2.2 Preparation for Reuse

Stakeholders were asked if they agreed with the principle that separate targets should be set for preparation for reuse. Responses to this question are summarised in Table 2-3. Those stakeholders who responded that they felt that there should be no such targets were automatically directed to the next section of the consultation (see Section 2.3).

Table 2-3: Should the Commission Set New Preparation for Reuse Targets?

Answer		All Stakeholders	Stakeholder Group						
			Industry Trade Bodies	Industry Representatives	Not-for-Profit Organisations	Academic Institutions	Other Organisations	Public Authorities	European Citizens
Yes	No.	211	38	20	39	3	10	31	70
	%	46%	28%	25%	72%	50%	50%	63%	60%
No	No.	251	98	60	15	3	10	18	47
	%	54%	72%	75%	28%	50%	50%	37%	40%
Total	***No.***	***462***	***136***	***80***	***54***	***6***	***20***	***49***	***117***
	%	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

Respondents in favour of setting new preparation for reuse targets were asked which waste streams, materials, or products they thought should be targeted (respondents were allowed to identify up to four items). The range of materials identified by each of the three main stakeholder groups is presented in Table 2-4.

Table 2-4: List of Waste Streams, Materials or Products that could be the Focus of Preparation for Reuse Targets

Industry, Not-for-Profit, Academic and Other Organisations		Public Authorities		European Citizens	
Waste Streams/Materials/Products	**No. of Responses**	**Waste Streams/Materials/Products**	**No. of Responses**	**Waste Streams/Materials/Products**	**No. of Responses**
Textiles	35	Textiles	15	WEEE	10
WEEE	35	Furniture	13	Furniture	7
Furniture	34	WEEE	10	Textiles	3
Beverage bottles	13	End-of-life vehicles	3	Glass	2
Toys	6	Construction & Demolition waste	2	Glass bottles	2
Glass bottles	4	Glass	2	End-of-life vehicles	2
End-of-life vehicles	3	Household waste	1	Toys	2
Bulky waste	2	Bulky waste	1	Household waste	1
Glass	2	Plastics	1	Wood	1
Plastics	2	Clothing	1	Plastics	1
Wood	1	Beverage bottles	1	Mobile Phones	1
Metals	1	Paint	1	Bicycles	1
Batteries and/or accumulators	1			Cans	1
Cans	1			Chemicals	1
Nappies	1				
Commercial transit packaging	1				
Specialty fibres such as aramides and carbon fibre	1				

2.3 Recycling Rates

The European Commission is keen to see that more materials are recycled, especially critical raw materials and those that have a significant impact on the environment. In light of this, stakeholders were asked whether they thought that recycling rates should be increased and /or made to include more materials/waste streams. Responses to this question are summarised in Table 2-5. Those stakeholders who responded that they felt that there should be no such targets were automatically directed to the next section of the consultation (see Section 2.4).

Table 2-5: Should the Commission Increase or Expand Existing Recycling Targets?

Answer		All Stakeholders	Stakeholder Group						
			Industry Trade Bodies	Industry Representatives	Not-for-Profit Organisations	Academic Institutions	Other Organisations	Public Authorities	European Citizens
Yes	No.	390	101	66	44	5	17	42	115
	%	84%	74%	83%	81%	83%	85%	86%	98%
No.	No	72	35	14	10	1	3	7	2
	%	16%	26%	18%	19%	17%	15%	14%	2%
Total	**No**	**462**	**136**	**80**	**54**	**6**	**20**	**49**	**117**
	%	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Stakeholders who believed that current recycling targets should be revised, were asked to define the highest level of recycling that they felt could reasonably be obtained for the following waste streams by 2025:

- Household waste;
- Municipal waste;
- Commercial waste;
- Industrial waste; and
- Construction and demolition waste.

The weighted average recycling rate reported are presented for all stakeholders in Figure 2-4 and for each stakeholder group in Figure 2-5.

Figure 2-4: Average of Highest Achievable Recycling Rates Reported by all Stakeholders

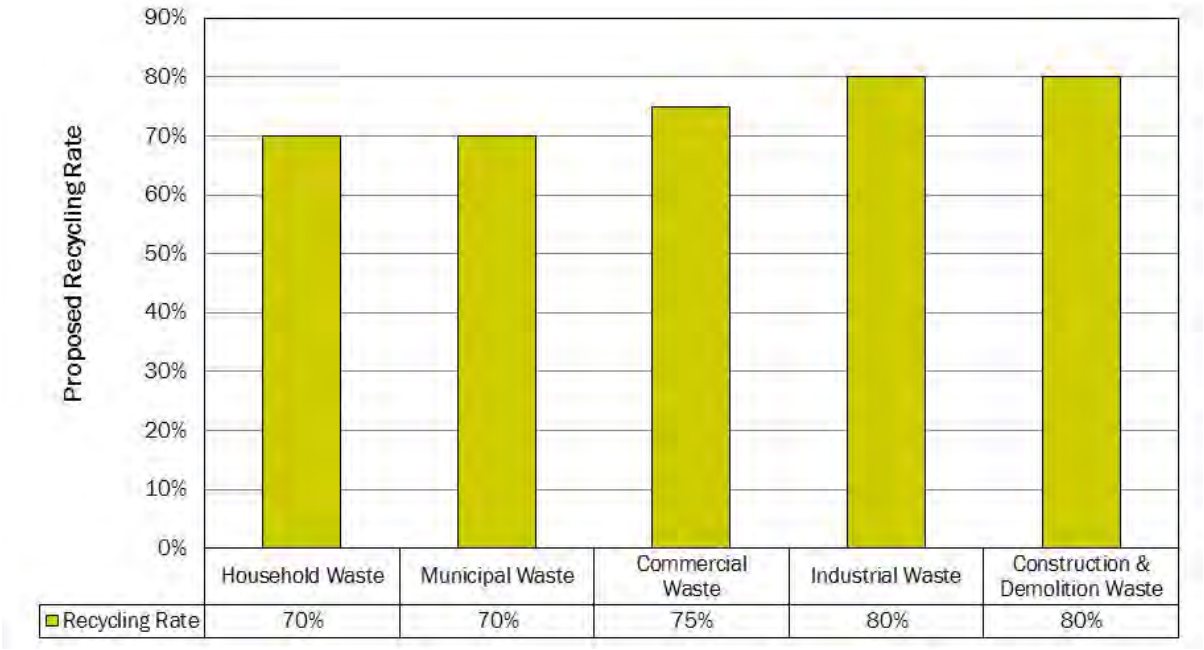
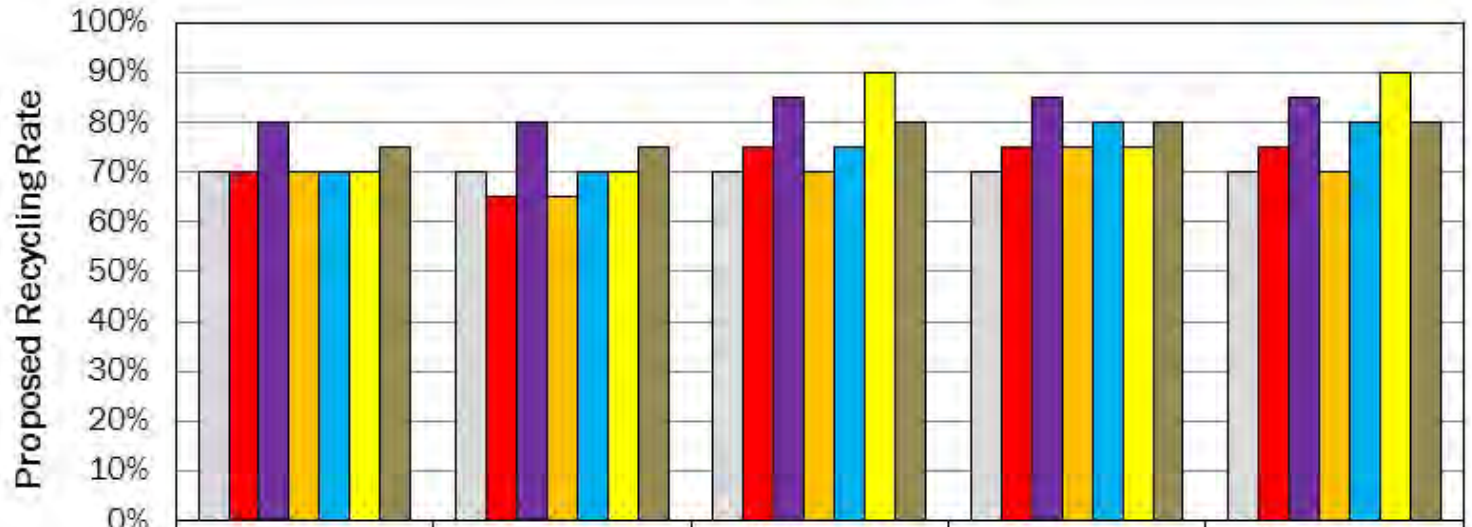


Figure 2-5: Average of Highest Achievable Recycling Rates Reported by all Stakeholder Groups



	Household Waste	Municipal Waste	Commercial Waste	Industrial Waste	Construction & Demolition Waste
Industry Trade Bodies	70%	70%	70%	70%	70%
Industry Representatives	70%	65%	75%	75%	75%
Not-for-Profit Organisations	80%	80%	85%	85%	85%
Academic Institutions	70%	65%	70%	75%	70%
Other Organisations	70%	70%	75%	80%	80%
Public Authorities	70%	70%	90%	75%	90%
European Citizens	75%	75%	80%	80%	80%

In order to take into account the large differences between Member States' current recycling levels, stakeholders were asked whether they supported an approach which would set targets relative to the existing situation in each Member State (for example, setting recycling rates that increased by a given amount each year). Responses to this question are presented in Table 2-6.

Table 2-6: Should Recycling Targets be Set According to the Situation within Individual Member States?

Answer		All Stakeholders	Stakeholder Group						
			Industry Trade Bodies	Industry Representatives	Not-for-Profit Organisations	Academic Institutions	Other Organisations	Public Authorities	European Citizens
Yes	No.	193	45	32	32	3	8	21	52
	%	60%	58%	70%	82%	60%	50%	58%	51%
No	No.	128	32	14	7	2	8	15	50
	%	40%	42%	30%	18%	40%	50%	42%	49%
Total	***No.***	***321***	***77***	***46***	***39***	***5***	***16***	***36***	***102***
	%	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

At present only municipal waste and construction and demolition waste are covered by specific recycling targets in the Waste Framework Directive, whilst other Directives cover packaging, WEEE, ELVs and batteries. The consultation asked whether stakeholders thought that there was a case for setting recycling targets on waste streams, materials, or products that are not already covered by targets in existing Directives. A range of answers were provided and each of these was coded to identify commonality across responses – the results of these responses are presented in Table 2-7 for the three main stakeholder groups.

Table 2-7: List of Waste Streams, Materials or Products that could be the Focus of New Recycling Targets

Industry, Not-for-Profit, Academic and Other Organisations		Public Authorities		European Citizens	
Waste Streams/Materials/Products	**No. of Responses**	**Waste Streams/Materials/Products**	**No. of Responses**	**Waste Streams/Materials/Products**	**No. of Responses**
Biowastes	49	Biowastes	9	Biowastes	9
Textiles	28	Plastics	6	Beverage cartons	6
Commercial and industrial waste	18	Textiles	5	Industrial waste	3
Bulky waste	17	Commercial waste	3	Textiles	3
Commercial waste	15	Industrial waste	2	Plastics	3
Beverage cartons	15	Hazardous waste	2	Commercial waste	2
Plastics	14	Food	2	Tyres	2
Industrial waste	12	Critical materials	2	Commercial and industrial waste	2
Furniture	9	All waste streams	2	Household waste	1
Hazardous waste	5	Bulky waste	1	Bulky waste	1
Food	4	Furniture	1	Hazardous waste	1
All waste streams	4	Non-packaging rigid plastics	1	Furniture	1
Wood	3	Household oil	1	Other scrap metal	1
Glass	2	Tyres	1	Toys	1
Tyres	2	Commercial and industrial waste	1	All waste streams	1
Flat glass	2				
Household waste	1				
C&D waste	1				
Paper / Cardboard	1				
Metals	1				
Ships	1				
Bio-plastics	1				

Industry, Not-for-Profit, Academic and Other Organisations		Public Authorities		European Citizens	
Waste Streams/Materials/Products	**No. of Responses**	**Waste Streams/Materials/Products**	**No. of Responses**	**Waste Streams/Materials/Products**	**No. of Responses**
Incinerator bottom ash	1				
Waste oils	1				
Mobile phones	1				
Autoclaved Aerated Concrete	1				
Packaging waste	1				
Floor coverings, matrasses	1				
Composite materials	1				
Sewage sludge	1				

2.4 Limiting Incineration of Waste Which Might Otherwise be Recycled

As stated above the Roadmap aims to ensure that energy recovery is limited to non-recyclable materials. In light of this, stakeholders were asked whether they supported the notation that a maximum level should be set for the amount of waste that can be incinerated for different waste streams. The responses to this question are presented for each group of stakeholders in Table 2-8. Those who stated that this would not be a good idea were not required to respond to the remaining questions in this section.

Table 2-8: Should the Commission Set Maximum Levels on the Amount of Waste that can be Incinerated?

Answer		All Stakeholders	Stakeholder Group						
			Industry Trade Bodies	Industry Representatives	Not-for-Profit Organisations	Academic Institutions	Other Organisations	Public Authorities	European Citizens
Yes	No.	264	58	48	33	3	9	19	94
	%	57%	43%	60%	61%	50%	45%	39%	80%
No	No.	198	78	32	21	3	11	30	23
	%	43%	57%	40%	39%	50%	55%	61%	20%
Total	***No.***	***462***	***136***	***80***	***54***	***6***	***20***	***49***	***117***
	%	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

Those in support of the idea that maximum levels of incineration should be set were asked more specifically which waste stream (or streams) this should apply to. The following options were provided:

- Household/municipal waste;
- Commercial waste;
- Industrial waste; and
- Construction and demolition waste.

The results of this question are presented in Table 2-9, which is broken down by waste stream and stakeholder group.

Table 2-9: Number of Stakeholders Who Do and Do Not Support Maximum Incineration Levels for Different Waste Streams

Waste Stream / Answer		All Stakeholders	Stakeholder Group						
			Industry Trade Bodies	Industry Representatives	Not-for-Profit Organisations	Academic Institutions	Other Organisations	Public Authorities	European Citizens
Household/Municipal Waste									
Yes, introduce limits on incineration	No.	151	27	24	30	2	5	12	51
	%	89%	84%	89%	100%	67%	71%	75%	94%
No, do not introduce limits on incineration	No.	18	5	3	0	1	2	4	3
	%	11%	16%	11%	0%	33%	29%	25%	6%
Commercial Waste									
Yes, introduce limits on incineration	No.	135	25	14	30	2	6	11	47
	%	90%	86%	78%	100%	67%	75%	73%	100%
No, do not introduce limits on incineration	No.	15	4	4	0	1	2	4	0
	%	10%	14%	22%	0%	33%	25%	27%	0%
Industrial Waste									
Yes, introduce limits on incineration	No.	118	19	14	29	1	4	7	44
	%	81%	73%	74%	100%	33%	57%	50%	92%
No, do not introduce limits on incineration	No.	28	7	5	0	2	3	7	4
	%	19%	27%	26%	0%	67%	43%	50%	8%
Construction & Demolition Waste									
Yes, introduce limits on incineration	No.	110	16	13	27	0	4	9	41
	%	76%	64%	68%	93%	0%	50%	64%	89%
No, do not introduce limits on incineration	No.	34	9	6	2	3	4	5	5
	%	24%	36%	32%	7%	100%	50%	36%	11%

Respondents who supported the idea of applying maximum levels of incineration to either one or more of the above waste streams were asked to state what they believed was an appropriate maximum level (as a percentage of each waste stream). The results of this question are presented in Table 2-10, where the weighted average maximum incineration rate for each waste stream is presented for each group of stakeholders.

Table 2-10: Average Maximum Levels of Incineration Suggested by Stakeholders

Waste Stream	All Stakeholders	Stakeholder Group						
		Industry Trade Bodies	Industry Representatives	Not-for-Profit Organisations	Academic Institutions	Other Organisations	Public Authorities	European Citizens
Household/Municipal Waste	21%	28%	23%	14%	23%	32%	23%	23%
Commercial Waste	21%	27%	25%	12%	23%	30%	23%	23%
Industrial Waste	19%	24%	23%	12%	20%	29%	23%	20%
Construction & Demolition Waste	20%	20%	28%	14%	25%	15%	25%	20%

In addition to the above four waste streams stakeholders were asked to identify any other waste streams to which a maximum level of incineration should apply. These responses were coded to identify common responses and the results are presented in Table 2-11.

Table 2-11: List of Waste Streams to which it was Suggested Maximum Incineration Levels Should Apply

Industry, Not-for-Profit, Academic and Other Organisations		Public Authorities		European Citizens	
Waste Streams/Materials/Products	**No. of Responses**	**Waste Streams/Materials/Products**	**No. of Responses**	**Waste Streams/Materials/Products**	**No. of Responses**
Packaging	18	Tyres	2	Packaging	6
Biowastes and/or Biomass	14	Biowastes and/or Biomass	1	Biowastes and/or Biomass	5
Medical waste	13	Plastics	1	Medical waste	2
Plastics	10	Waste oils	1	Not a relevant response	1
Paper and card	7	Medical waste	1	Hazardous waste	1
Wood	3	PVC	1	Batteries	1
WEEE	3	Non-toxic waste streams that can easily be recycled (e.g. paper)	1	Wood	1
Packaging waste	2			Plastics	1
Metals	2			WEEE	1
Bulky waste	1			Paper and card	1
Hazardous waste	1				
Tyres	1				
Waste oils	1				
End-of-life vehicles	1				
Food waste	1				
Refuse derived fuel (RDF)	1				
Textiles	1				
Furniture	1				
Biodegradable waste	1				

2.5 Landfill

There are a number of possible ways in which the Commission's aspirational target that landfill should be 'virtually eliminated' could be implemented. Several options for achieving this were presented in the consultation:

1. Landfilling should be limited to residues from a specified range (to be determined) of waste treatment operations.
2. Landfilling should be limited to a certain percentage of waste generated (for instance 5%) from a particular date.
3. Landfilling of recyclable/compostable waste (to be defined) should be banned.
4. Landfilling of waste that is combustible should be banned.
5. Landfilling of waste should be banned if it has not been pre-treated to a level where the potential to lead to methane emissions from landfills has been virtually eliminated.

As described above, respondents were asked to rank the above options on a scale of 1 to 5, where:

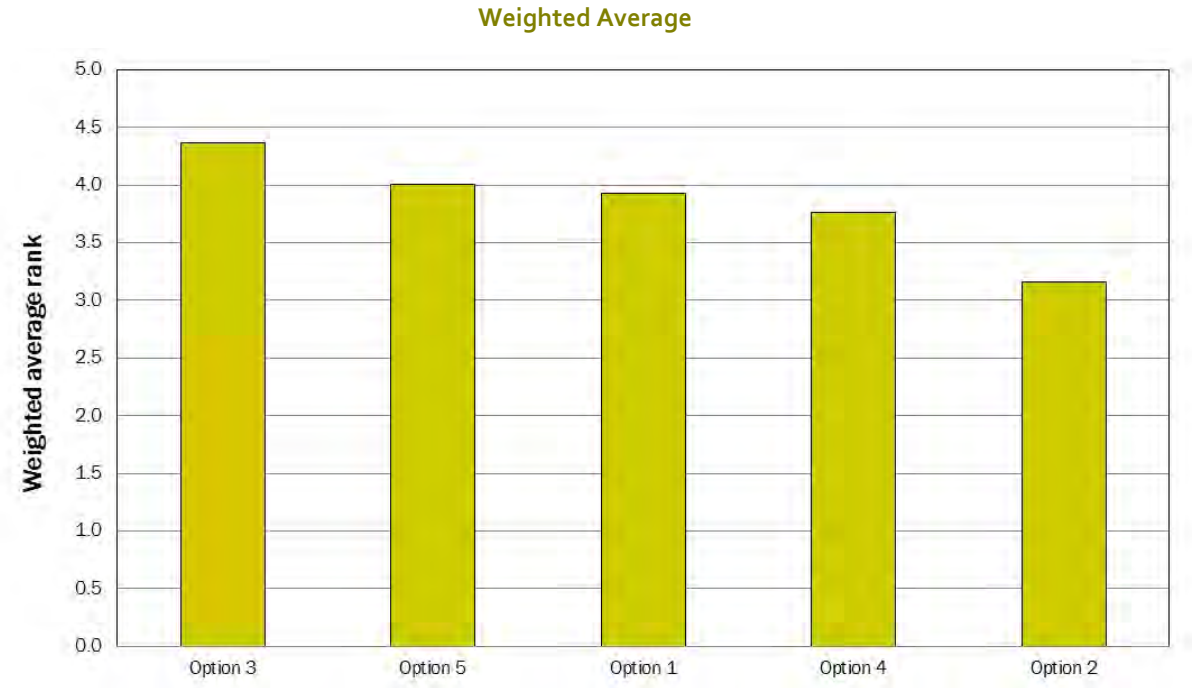
- 1 = poor idea, not worth consideration;
- 3 = moderately good idea, may be worth further consideration; and
- 5 = very good idea, definitely deserves further consideration.

The results of the responses to this question are presented for all stakeholders in Figure 2-6 and for each stakeholder group in Figure 2-7 and Figure 2-8. In each of these figures the 5 options represent those listed above and the reader should refer back to this list in order to identify which options were most favoured by respondents. As described in Section **Error! Reference source not found.** the results of this ranking exercise are presented in two ways:

1. As a weighted average rank; and
2. As the difference in the number of respondents who ranked an option as '5' vs. those who ranked it as '1'.

In the pages below each figure contains two graphs which present the results of the above two analyses.

Figure 2-6: Scoring of Options by all Stakeholders



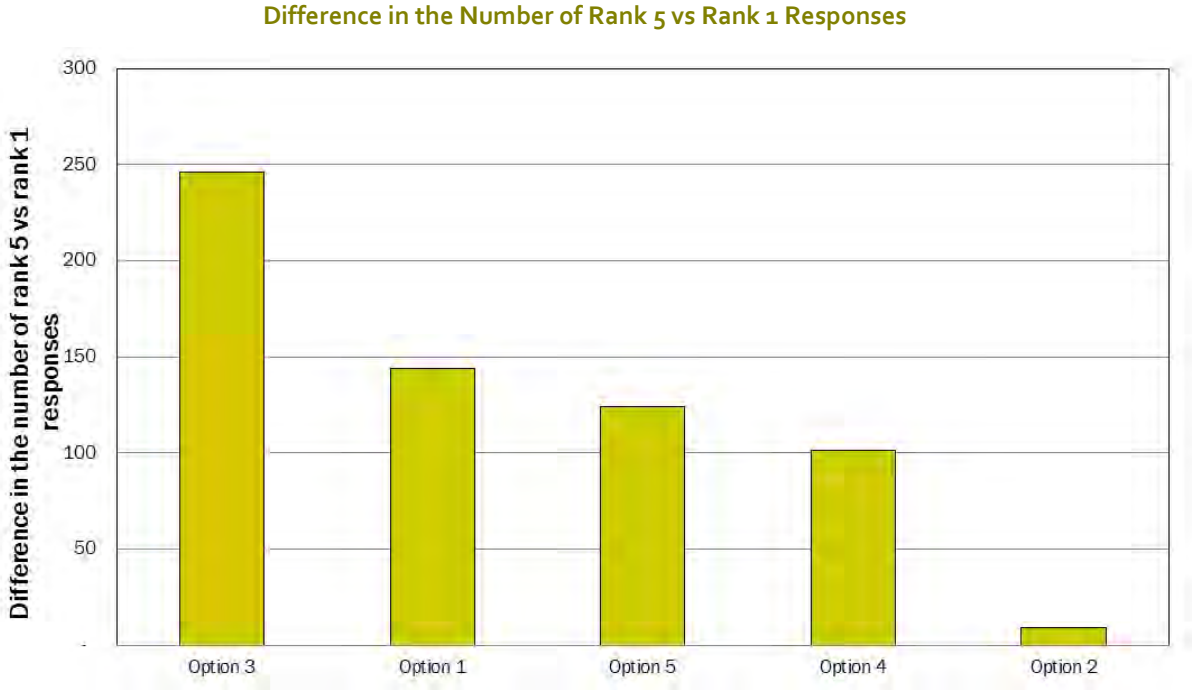
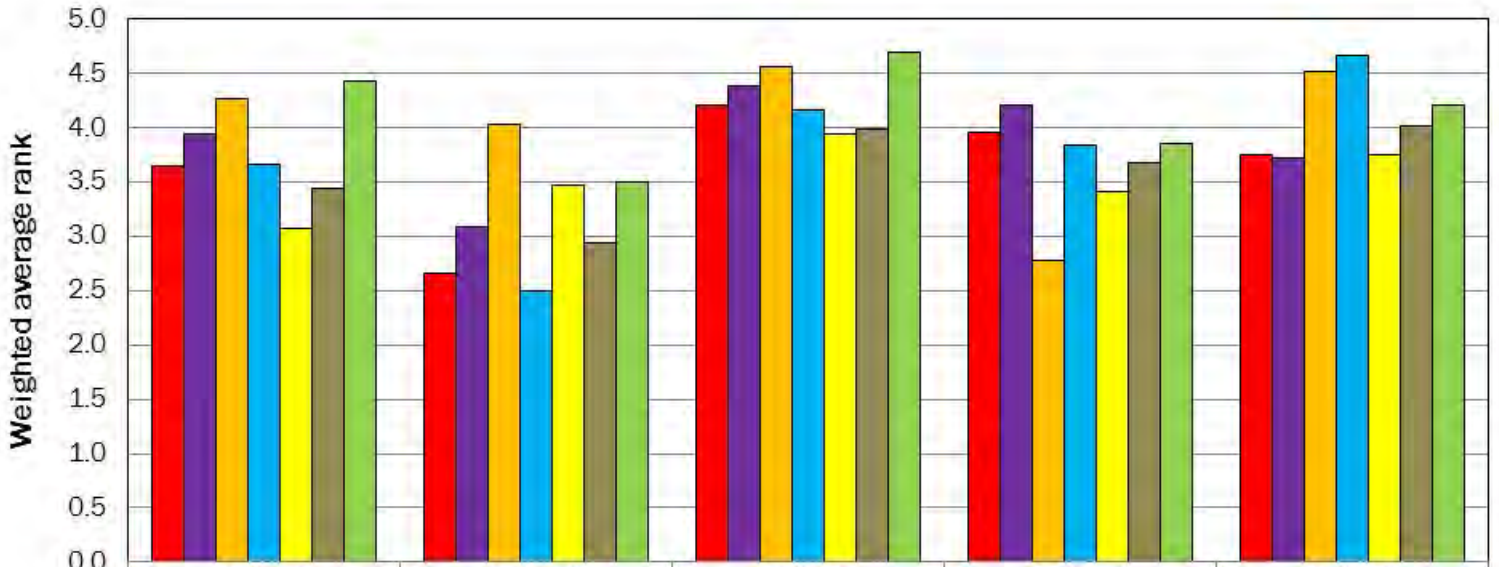
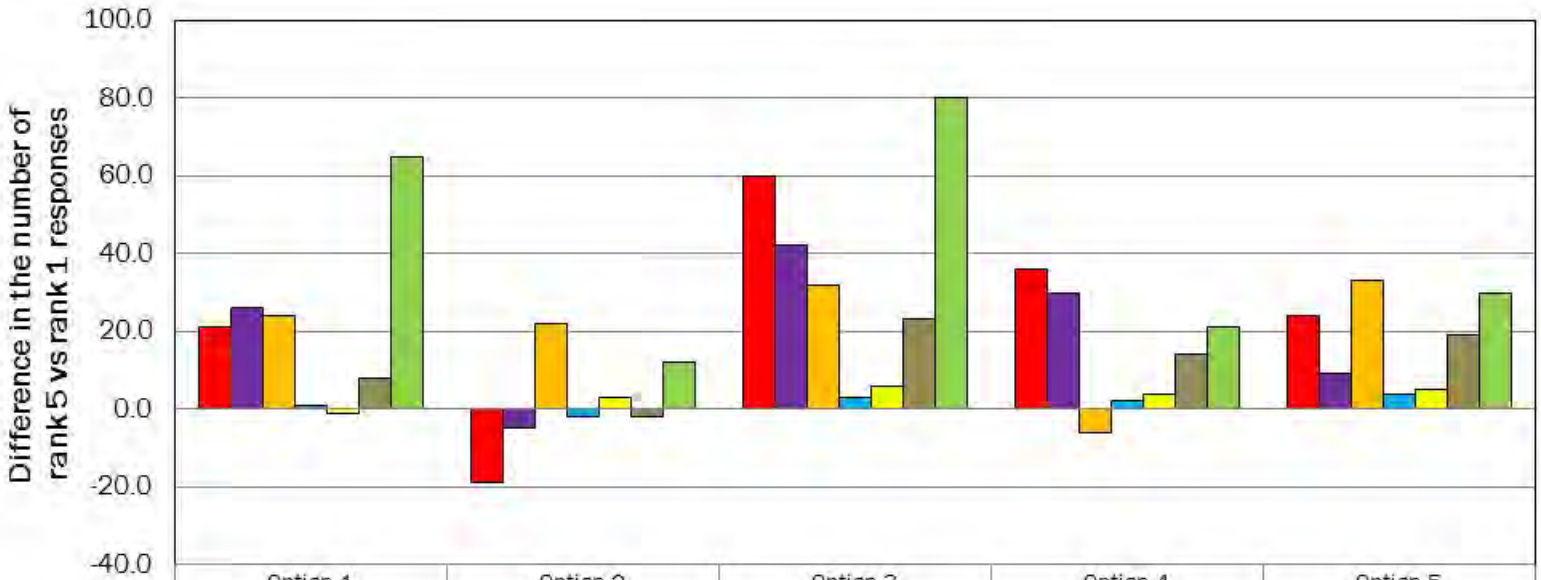


Figure 2-7: Scoring of Options by all Stakeholder Groups, Weighted Average Rank



	Option 1	Option 2	Option 3	Option 4	Option 5
Industry Trade Bodies	3.6	2.7	4.2	3.9	3.7
Industry Representatives	3.9	3.1	4.4	4.2	3.7
Not-for-Profit Organisations	4	4	5	3	5
Academic Institutions	3.7	2.5	4.2	3.8	4.7
Other Organisations	3.1	3.5	3.9	3.4	3.8
Public Authorities	3.4	2.9	4.0	3.7	4.0
European Citizens	4.4	3.5	4.7	3.8	4.2

Figure 2-8: Scoring of Options by all Stakeholder Groups, Rank 5 vs. Rank 1



	Option 1	Option 2	Option 3	Option 4	Option 5
Industry Trade Bodies	21	-19	60	36	24
Industry Representatives	26	-5	42	30	9
Not-for-Profit Organisations	24	22	32	-6	33
Academic Institutions	1	-2	3	2	4
Other Organisations	-1	3	6	4	5
Public Authorities	8	-2	23	14	19
European Citizens	65	12	80	21	30

In addition to the listed options which were scored as part of the closed-ended scoring matrix stakeholders were also asked to list any additional solutions that they felt had not already been identified and should potentially be considered. These open-ended responses were coded to identify the different themes that emerged from these responses. The additional solutions that were suggested by all stakeholder groups are presented in Table 2-12.

Table 2-12: Additional Suggestions Proposed by Stakeholders

Suggested Solution	Number of Times Solution Identified by Respondents
Introduction of targets should be staged or reduced by a given percentage each year	13
Set landfilling and incineration rates as a maximum amount of pre-treated waste per capita which decreases over time	11
Feasible alternatives must exist before landfill bans are implemented	10
Outright bans are inappropriate - some landfilling will always be necessary	7
The target should focus on distinct waste streams that can easily be monitored/identified (e.g. C&I waste and municipal waste)	6
Targets and/or bans should not be set, Member States should use other instruments to achieve objectives	6
Introduce mandatory landfill taxes	5
Introduce a requirement that all waste should be sorted prior to land filling and/or incineration	5
European Commission funding must enforce the waste hierarchy	4
Implement a complete landfill ban as a future target	3
Legislative efforts should focus on landfill taxes rather than bans	3
Progressive increases in landfill taxes for member states	3
Member State which landfill more than X% of its waste should be required to agree an Action Plan of national measures to reduce the amount of waste sent to landfill	3
Ban sorted wastes from landfill	3
Targets should be based on persistence of pollutants as well as toxicity of waste being landfilled	2
Targets must be backed up by strict enforcement strategy	2
Reduction in landfilling must be linked to a reduction in incineration	2
Increase existing Landfill Directive targets on biodegradable waste	2
Maintain existing landfill targets which focus on biodegradable waste only	2
Disposal of waste in landfills should be restricted to residues of certain waste treatment processes	2
Landfilling rate could be set as a maximum amount of waste per capita decreasing over a period of time	1
The targets need to take into account the specific situation on islands and take this into account	1
Member States should have the freedom to voluntary negotiate appropriate targets with the European Commission	1
Ban single use plastics from landfill (e.g. single use plastic bags)	1

Suggested Solution	Number of Times Solution Identified by Respondents
Need better data before setting targets	1
Strict acceptance criteria for landfills should be established for distinct waste streams	1
Ban biodegradable waste from landfill	1
Ban recyclable wood from landfill	1
Ban certain critical materials from landfill	1
Response was not relevant to this section	66
Solution was already listed in the consultation / Response was a comment on proposed solutions	28
Response highlighted an issue	7

In order to take into account the large differences between Member States' current levels of landfilling, respondents were asked whether they supported an approach which would set targets relative to the existing situation in each Member State (for example, setting a landfilling reduction percentage per year). Responses to this question are presented in Table 2-13.

Table 2-13: Should Landfilling Targets be Set According to the Situation within Individual Member States?

Answer		All Stakeholders	Stakeholder Group						
			Industry Trade Bodies	Industry Representatives	Not-for-Profit Organisations	Academic Institutions	Other Organisations	Public Authorities	European Citizens
Yes	No.	176	49	30	31	3	6	23	34
	%	68%	60%	67%	78%	75%	46%	64%	83%
No	No.	84	32	15	9	1	7	13	7
	%	32%	40%	33%	23%	25%	54%	36%	17%
Total	***No.***	***260***	***81***	***45***	***40***	***4***	***13***	***36***	***41***
	%	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

3.0 Targets as a Tool in Waste Legislation

The first question in this section of the consultation asked whether stakeholders thought that the Commission should go further than simply setting targets for Member States to achieve. The responses received to this question are summarised in Table 3-1.

Table 3-1: Should the Commission go Further than Simply Setting Targets?

Answer		All Stakeholders	Stakeholder Group						
			Industry Trade Bodies	Industry Representatives	Not-for-Profit Organisations	Academic Institutions	Other Organisations	Public Authorities	European Citizens
Yes	No.	394	116	61	48	3	18	41	107
	%	85%	85%	76%	89%	50%	90%	84%	91%
No	No.	68	20	19	6	3	2	8	10
	%	15%	15%	24%	11%	50%	10%	16%	9%
Total	***No.***	***462***	***136***	***80***	***54***	***6***	***20***	***49***	***117***
	%	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

Those who felt that setting targets was insufficient for achieving the objectives set out in the Roadmap were asked to state, by simply entering 'yes' or 'no', whether they believed the following options would be appropriate:

1. Develop guidance on the implementation of effective producer responsibility schemes to improve the transparency of the systems as well as their cost effectiveness.
2. Develop guidance on the proper implementation of the waste hierarchy.
3. Ensure a closer monitoring by the Commission of progress accomplished by Member States in applying the waste hierarchy. For those Member States moving too slowly to meet the legally binding targets, develop mechanisms to ensure that key instruments such as a combination of economic and legal instruments (landfill/incineration taxes/bans, EPR schemes, incentives for municipalities and citizens, etc) are applied.
4. Develop criteria for municipalities to implement services of a minimum standard to enable sorting of a range of waste materials for recycling and composting/anaerobic digestion.
5. Improve the consistency of the definitions used in the legislation and ensure proper monitoring by improved data collection and systematic reliability and validity

checks of data reported.

The responses received to these options were analysed for each group of stakeholders and the results have been summarised in

Table 3-2.

Table 3-2: Number of Stakeholders Who Stated that Proposed 'Non-target' Options were either Appropriate or Inappropriate

Waste Stream / Answer		All Stakeholders	Stakeholder Group						
			Industry Trade Bodies	Industry Representatives	Not-for-Profit Organisations	Academic Institutions	Other Organisations	Public Authorities	European Citizens
Option 1: Develop guidance on the implementation of effective producer responsibility schemes to improve the transparency of the systems as well as their cost effectiveness.									
Appropriate	No.	314	85	37	44	3	14	35	96
	%	85%	79%	64%	98%	100%	82%	90%	94%
Inappropriate	No.	57	22	21	1	0	3	4	6
	%	15%	21%	36%	2%	0%	18%	10%	6%
Option 2: Develop guidance on the proper implementation of the waste hierarchy.									
Appropriate	No.	302	100	53	39	2	16	36	56
	%	93%	95%	93%	87%	100%	89%	95%	92%
Inappropriate	No.	24	5	4	6	0	2	2	5
	%	7%	5%	7%	13%	0%	11%	5%	8%
Option 3: Ensure a closer monitoring by the Commission of progress accomplished by Member States in applying the waste hierarchy.									
Appropriate	No.	339	98	51	45	2	14	29	100
	%	92%	91%	89%	98%	67%	88%	81%	97%
Inappropriate	No.	30	10	6	1	1	2	7	3
	%	8%	9%	11%	2%	33%	13%	19%	3%
Option 4: Develop criteria for municipalities to implement services of a minimum standard to enable sorting of a range of waste materials for recycling and composting/anaerobic digestion.									
Appropriate	No.	255	69	41	43	2	10	27	63
	%	85%	79%	85%	96%	100%	63%	73%	95%
Inappropriate	No.	46	18	7	2	0	6	10	3
	%	15%	21%	15%	4%	0%	38%	27%	5%
Option 5: Improve the consistency of the definitions used in the legislation and ensure proper monitoring by improved data collection and systematic reliability and validity checks of data reported.									
Appropriate	No.	366	109	57	46	3	16	35	100

	%	98%	98%	97%	100%	100%	94%	95%	98%
Inappropriate	No.	9	2	2	0	0	1	2	2
	%	2%	2%	3%	0%	0%	6%	5%	2%

In addition to the listed options which were scored as part of the closed-ended scoring matrix stakeholders were also asked to list any additional solutions that they felt had not already been identified and should potentially be considered. These open-ended responses were coded to identify the different themes that emerged from these responses. The additional solutions that were suggested by all stakeholder groups are summarised in Table 3-3.

Table 3-3: Additional Suggestions for Revision Provided by all Stakeholders

Suggested Solution	Number of Times Solution Identified by Respondents
Make separate glass collections mandatory	24
Make separate collections of certain waste streams mandatory	16
The EC should no longer fund incineration facilities	16
Encourage application of economic instruments to promote resource efficiency	13
Create a register of EU approved facilities for recycling exports outside the EU	10
Provide guidance on how to targets can be achieved	9
Set up a platform to enable the exchange of good practices between Member States.	8
Introduce extended producer warranties (e.g. extend from 2 to 10 years)	8
Assess resource use with life cycle approaches	6
Ensure that local NGOs have a say in the definition of waste plans	6
Make separate biowaste and/or textile collections mandatory	6
European Commission funding must enforce the waste hierarchy	6
Member States should do more to raise public awareness of waste related issues (e.g. recycling and waste prevention)	4
Strict enforcement of the targets and Directives	3
All national, regional and local waste plans must explain how they are planning to fulfil EU legislation	2
Measures should be taken to prevent incineration overcapacity	2
Introduce a single overarching reuse, recycling, and recovery target	2
Promote the implementation of voluntary initiatives/agreements with relevant stakeholders	2
Need greater focus on eco-design and extended producer responsibility to improve recycling and reduce arisings	2
Apply standardised methods to assess 'decoupling'	1
More measures to minimize excessive packaging	1
Charge companies for the cost of disposal/recycling of their products	1
Ban planned obsolescence	1

Suggested Solution	Number of Times Solution Identified by Respondents
Guidance must not interfere with appropriate national and local decision making processes	1
Place a tax proportional to total environmental impact on products sold	1
Remove any waste regulation barriers to private sector recycling	1
Improve Extended Producer Responsibility schemes for C&D materials/products	1
Establish fiscal control measures for extended producer responsibility schemes	1
Make an EU wide requirement for free public waste recycling centres	1
Tiered levels of enforcement action to lift performance of the lowest achievers more quickly	1
Set technical and environmental standards for landfills	1
Monitoring the reuse and recycling initiatives should be the basis for future proposals	1
There should be a greater focus on Extended Producer Responsibility	1
Clamp down on the export of illegal waste	1
Develop a Blueprint on Waste as has been produced for water	1
Promote incentive schemes to encourage innovation and behaviour change	1
European Commission funding should be conditional on pre-defined objectives/criteria	1
Reduce burden of waste legislation on SMEs	1
Provide clarification on the application of the waste hierarchy in relation to hazardous waste	1
More focus is required on end of waste criteria	1
The EC should provide guidance on stimulating and incentivising a circular economy	1
Introduce quality standards for recyclates	1
Not a relevant response for this section/ response is an issue rather than a proposal	66
Response was a comment on proposed solutions / Solution was already listed in the consultation	32

4.0 Citizen Consultation

It will be evident from the results presented in the above sections that European citizens were given the option of responding to the more technical consultation that was open to all stakeholders. In addition, the Commission developed a number of standalone questions to which citizens could respond if they did not wish to respond to the longer consultation that was open to all stakeholders. Citizens were able to express their views in one of three ways:

1. Through the shorter citizen consultation;
2. Via the technical consultation that was open to all stakeholders; or
3. Through both the shorter citizen consultation and the longer technical consultation.

The results of those citizens who responded to the technical consultation have already been presented in the sections above. This section presents the results of the responses which were received to the shorter citizen specific consultation. The number of responses received for each of the above three options is presented in Table 4-1.

Table 4-1: Number of Responses Received From European Citizens

Question	Number of Responses	% Based on Number of Responses to Question
I would like to express my views through the shorter citizen consultation.	208	64%
I would like to respond to the technical consultation that is open to all stakeholders.	47	14%
I would like to express my views through both the shorter citizen consultation and the longer technical consultation.	70	22%
Total	***325***	***100%***

The first question asked of citizens was whether they made efforts to reduce the amount of household waste that they produce. The responses to this question are presented in Table 4-2.

Table 4-2: Number of Citizens Who Reported Making Efforts to Reduce the Amount of Waste that They Produce

Answer	Number of Responses to Question	% Based on Number of Responses to Question
Yes, make efforts to reduce waste arisings	269	97%
No, make no efforts to reduce waste arisings	9	3%
Total	***278***	***100%***

Those citizens who reported that they were making efforts to reduce the amount of waste that they produced were asked what steps they were taking to do so from a list of predefined options

(respondents could choose one or more options). This list is reproduced in Table 4-3 which also provides a summary of which actions were most popular.

Table 4-3: Types of Actions Taken by Citizens to Reduce Waste Arisings

Answer	Number of Responses to Question	% Based on Number of Citizens Who Make Efforts to Reduce their Waste Arisings
I avoid food and other waste by buying exactly what I need.	219	81%
I avoid buying 'over packaged' goods.	184	68%
I have taken efforts to stop receiving unwanted mail.	159	59%
I undertake home composting.	120	45%
I use rechargeable batteries as far as possible.	176	65%
I drink tap water to avoid packaging waste.	188	70%
I use reusable nappies on my children.	19	7%
I donate/sell items for reuse.	197	73%
I make efforts to get broken appliances repaired before buying new ones.	179	67%
Other actions	82	30%
Total	***1,523***	-

Those citizens who reported that they made no efforts to reduce the amount of waste that they produced were asked what the main reasons were for this. Again, respondents were given the option of choosing one or more answers from a predefined list. The list of possible answers and the results are presented in Table 4-4.

Table 4-4: Reasons for Citizens Not Acting to Reduce Waste Arisings

Answer	Number of Responses to Question	% Based on Number of Citizens Who *do not* Make Efforts to Reduce their Waste Arisings
Reducing waste is not important.	1	11%
There is no public incentive to produce less waste.	3	33%
I do not know how I can reduce waste (for example, through home composting).	5	56%
It is the responsibility of the product producer to reduce waste, not mine.	2	22%
Other reasons.	3	33%
Total	***14***	-

Moving on from waste prevention to recycling, citizens were asked if they sort their waste material

out for recycling. The number of 'Yes'/'No' responses received to this question are shown in Table 4-5. Citizens who reported making efforts to sort materials out for recycling were asked what encouraged them to do this. The listed closed-ended answers which were provided and the responses to these are shown in Table 4-6. In a similar vein, citizens who stated that they did not sort out materials for recycling were asked why this was the case. The responses to this question are reported in Table 4-7.

Table 4-5: Number of Citizens Who Reported Making Efforts to Sort Materials Out for Recycling

Answer	Number of Responses to Question	% Based on Number of Responses to Question
Yes, I currently sort my waste out for recycling	273	98%
No, I do not sort my waste out for recycling	5	2%
Total	***278***	***100%***

Table 4-6: Reasons for Citizens Acting to Sort Waste Out for Recycling

Answer	Number of Responses to Question	% Based on Number of Citizens Who Make Efforts to Sort Waste Out for Recycling
Sorting waste is compulsory in my municipality.	131	48%
I pay less if I sort my waste for recycling.	41	15%
I think recycling is good for the environment.	259	95%
I need to sort my waste so that my refuse bin does not become too full.	54	20%
It is something that the public authorities recommend I do.	72	26%
All my neighbours are sorting their waste.	33	12%
Other reasons.	42	15%
Total	***632***	-

Table 4-7: Reasons for Citizens *Not* Acting to Sort Waste Out for Recycling

Answer	Number of Responses to Question	% Based on Number of Citizens Who *do not* sort Waste out for Recycling
There is no separate collection service available in the area where I live.	3	60%
The recycling collection service is not convenient (e.g. I have to travel too far to reach the nearest facilities).	1	20%
There is not enough space in the recycling containers.	1	20%
The waste that is sorted for recycling is not collected often enough.	1	20%

It takes too much time to sort my waste.	3	60%
Organic wastes are not collected regularly enough.	1	20%
I have no place to store the sorted waste.	2	40%
Recycling is not my responsibility and should be done by the public authorities.	3	60%
There is no point in recycling as all the materials are burnt or landfilled anyway.	2	40%
I don't understand the sorting instructions that are required for me to separate my waste.	1	20%
Other reasons.	1	20%
Total	***19***	-

Citizens who reported that they made efforts to sort out materials for recycling were asked which wastes they regularly sorted out. A predefined list of wastes was provided and the responses to this list are presented in Table 4-8.

Table 4-8: Materials Regularly Sorted by Citizens

Answer	Number of Responses to Question	% Based on Number of Citizens Who Make Efforts to Sort Waste Out for Recycling
Paper	268	98%
Card	170	62%
Glass	258	95%
Metals	193	71%
Beverage cartons	212	78%
Aluminium	178	65%
Plastic bottles	256	94%
Other plastics	163	60%
Textiles (clothing)	162	59%
Garden waste	145	53%
Food waste	135	49%
Batteries	229	84%
Households hazardous waste (paint, chemicals, etc.)	146	53%
Electric and electronic waste equipment	195	71%
Other	31	11%
Total	***2,741***	***100%***

Citizens were also asked if they would sort out more wastes for recycling if the option to do so was made available to them. The number of 'Yes'/'No' responses to this questions can be seen in Table 4-9. Those citizens reported that they would like to sort out more wastes were asked to identify which materials they would like to see collected in a manner which was convenient to them. The responses to this question are shown in Table 4-10.

Table 4-9: Number of Citizens Who Would Sort Out More Wastes for Recycling if the

Option Was Available

Answer	Number of Responses to Question	% Based on Number of Responses to Question
Yes, I would sort out more wastes for recycling	240	88%
No, I would not sort out more wastes for recycling	33	12%
Total	***273***	***100%***

Table 4-10: Additional Wastes that Citizens Would Like to Sort Out for Recycling if it were Made Convenient to do so

Answer	Number of Responses to Question	% Based on Number of Citizens Who Make Efforts to Sort Waste Out for Recycling
Paper	26	11%
Card	40	17%
Glass	27	11%
Metals	63	26%
Beverage cartons	35	15%
Aluminium	62	26%
Plastic bottles	28	12%
Other plastics	80	33%
Textiles (clothing)	77	32%
Garden waste	59	25%
Food waste	91	38%
Batteries	44	18%
Households hazardous waste (paint, chemicals, etc.)	87	36%
Electric and electronic waste equipment	67	28%
Other	61	25%
Total	***847***	-

It is recognised that municipal waste management represents a cost for the public authorities. Citizens were therefore asked to select one of five options to demonstrate how they felt that these costs should be covered. The five options and the number of responses received for each are summarised in Table 4-11.

Table 4-11: How Should the Cost of Municipal Waste Collections be Covered?

Answer	Number of Responses to Question	% Based on Number of Responses to Question
General taxes paid by all citizens.	19	7%
Partly by general taxes, and partly by those placing products on the markets (such as producers of electronic goods, companies whose products are sold in packaging, etc.).	37	13%
Partly by general taxes, and partly by charges linked to the amount of unsorted waste produced by the household (so that those households producing less waste, or making greater efforts to recycle, are paying less than the others).	29	10%
By a combination of general taxes, contributions from companies selling goods whose packaging may end up as waste, and charges linked to the amount of unsorted waste produced by the household.	179	64%
Other.	14	5%
Total	***278***	***100%***

Where citizens reported on 'other' means whereby the costs of municipal waste collections should be recovered, the following was identified:[3]

- Four citizens stated that the costs of collection should be paid by a combination of pay-as-you-throw and companies who contribute household waste arisings;
- Three respondents the costs should be covered entirely by pay-as-you-throw schemes; and
- Three citizens felt that the costs should be covered entirely be the companies who sell products which contribute to household waste arisings.

[3] One response was unrelated to the questions, while three of the suggestions listed under the option 'other' were already identified in the consultation question.

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PART 6/6

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Proposal for a Directive of the European Parliament and of the Council

amending Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, 1999/31/EC on the landfill of waste, 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment

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Annex 8: An Overview of the European Reference Model on Waste

Contents

Introduction

This Annex is intended to provide a brief overview of the European Reference Model on Municipal Waste Management which has been used for analysing the policy options put forward in this Impact Assessment (IA). DG Environment at the European Commission, working with the European Environment Agency, commissioned Eunomia and Copenhagen Resource Institute (CRI) to develop this model which covers all 28 EU Member States. This model has been used, firstly, to develop scenarios which aid understanding of the gap between likely waste management performance in specific Member States and the targets for recycling, recovery and landfill diversion under existing legislation. In addition, it can be used to quantify the impact of different scenarios in respect of impacts on the environment, including (but not limited to) greenhouse gas emissions, job creation, and costs.

This short overview will briefly cover the following:

- How the model was developed;
- The baseline waste management scenarios in Member States;
- The core components of the model and how these are interlinked; and
- The key assumptions that underpin the analyses in each component.

It is important to note that a summary Annex such as this can only provide a very high level overview of the model. The technical documentation which accompanies the model[1] runs into many hundreds of pages and it is therefore not possible to fully expand on all of the assumptions that are made in the model; however, we endeavour here to provide a summary of the key points and assumptions that are essential to the results presented in this IA.

The model, built as a spreadsheet tool in Microsoft Excel 2010, is populated with national waste management data for all Member States (including Croatia). At its core sits the mass flow modelling, where data on waste arisings, recycling, and residual waste treatment are recorded for each Member State. The model has been designed to provide projections for the period 2010 to 2030. The model is to be housed and maintained by the EEA and should provide a useful resource for analysing the impacts of European waste policy.

[1] Eunomia Research & Consulting and Copenhagen Resource Institute (in development) *Development of a Modelling Tool on Waste Generation and Management*, Report for the European Commission DG Environment, www.wastemodel.eu

1.0 Model Creation

As well as initiatives taken by individual Member States to establish national projections, two particular studies have been taken at European level to model waste generation and management:

- The first undertaken for DG Environment in the context of an impact assessment on biowaste developed a modelling tool on municipal solid waste (MSW) generation and management;[2] and
- The second undertaken for the European Environment Agency supported by the European Topic Centre on Sustainable Consumption and Production calculated waste generation and treatment projections for each Member State, including the modelling of greenhouse gases (GHGs).[3]

These pieces of work provided a starting point for the development of the European Reference Model on Municipal Waste Management. The principles and methodologies established in the previous work have been used to develop a new model, built from scratch as a fit for purpose tool.

It is an important tool for national and pan-European strategic planning. Therefore, in order to ensure that it could be used to best effect, consultation with relevant personnel in government departments with responsibility for waste management was seen to be essential. Furthermore, industry consultation was also seen to be important to the model's development, and this was sought as a means of improving the quality of the information in the model.

As part of the model development relevant officials in all Member States were identified and sent a detailed questionnaire which requested country specific information which was required for input into the model. These questionnaires were sent out prior Member States being visited in person to gather further information and to better understand the missing data gaps in the questionnaires which had been returned prior to these face-to-face meetings. Nineteen Member States were visited by members of the project team and these visits helped to develop a much more detailed view of Member States' current performance and future plans with respect to waste management.[4] The countries which were not visited were felt to already being doing relatively well in terms of waste management and a substantial amount of information and data is already publically available; thus, information on these countries was gathered via the country questionnaire that was sent out and publically available sources of information.

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[2] Arcadis & Eunomia (2010) *Assessment of the Options to Improve the Management of Bio-waste in the EU*, Report for the European Commission http://ec.europa.eu/environment/waste/compost/developments.htm

[3] ETC/SCP (2011) *Projections of Municipal Waste Management and Greenhouse Gases*, Prepared by Bakas et al., 89 pp. Copenhagen, Denmark http://scp.eionet.europa.eu/publications/2011WP4

[4] The following Member States were visited: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Finland, France, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Spain, and Sweden.

Industry was consulted via an online consultation which was hosted on the project's official website.[5] This consultation sought to obtain further information from stakeholders on the following:

- Waste composition;
- Collection systems operated in Member States and collection costs; and
- Treatment system costs.

These sources of information were used as sources of input data for the model which had been developed by the project team.

2.0 Baseline Scenarios Included in the Model

Baselines have been developed within the model based on information gathered from a series of Member State visits and interviews with relevant national waste departments, and a questionnaire led data gathering exercise for non-visited countries.

The first challenge of this work was to formulate a reasonable understanding of current Member State waste management performance (i.e. how municipal waste arises and gets managed). This is not always straightforward, not least because the availability and quality of information and recent data varies from Member State to Member State. Beyond the current situation, future projections are required essentially to predict how total waste arisings, waste prevention, recycling, residual waste treatment and disposal levels will evolve over time.

For current performance, existing data sources (Eurostat data, the 2013 EEA "Managing Municipal Solid Waste" reports for each country[6] and any further specific national waste management studies) give an indication of the waste management practices in the Member States. The questionnaires and Member State visits conducted as part of the model development (Section 1.0) helped supplement and explain such information and allowed for the inclusion of finer levels of detail in the modelling, and in certain cases have led to an adjustment of the official statistics (such as figures reported for total municipal waste).

For future performance, an understanding is needed of the policies, strategies and plans for investment in municipal waste infrastructure. For countries where National Waste Plans (or similar) have recently been developed, and policies have been announced or put in place to deliver the intended objectives, then the likely progression is more certain. For other countries where national planning is less recent, currently still in development or simply less thorough, then future expectations must be tempered.

With this in mind, two baselines and one steady state waste management projection are established based on the existing data and the gathered information. These are defined as follows:

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[5] European Commission (2013) *Waste Management Model*, www.wastemodel.eu

[6] EEA (2013) *Managing municipal solid waste - a review of achievements in 32 European countries* http://www.eea.europa.eu/publications/managing-municipal-solid-waste

- Business As Usual Scenario: Steady State Waste Management:
    - This assumes that the levels of recycling and the share of waste treatment systems remain constant after the last reported year. This provides a base case against which to compare the more dynamic future projection baselines (and scenarios in the further analysis).
- Baseline 1: Likely Outlook Based on Current Information:
    - The primary baseline presents an objective view of likely future waste management based upon realistic expectations for the performance of deliverable future waste management systems. For certain Member States it is likely to be a more moderated and objective version of the second baseline scenario. It is intended to highlight what might be the outcome if nothing happens other than:
        - Waste prevention / preparation for re-use measures whose implementation has already commenced take full effect;
        - Collection systems remain as they are, unless a clear programme of roll-out of new systems is underway or committed to; and
        - Residual waste facilities for municipal waste either already built, or in the construction phase are fully utilised. These plans will affect assumptions about how residual waste is managed
- Baseline 2: Member State Intentions:
    - This secondary baseline simply reflects Member States' stated intentions. This implies a less critical review of what is likely to happen in future, and takes Member State intentions 'at face value'. Where Member State plans or intentions have not yet been published or made available, it was necessary to project conservatively.

The policy options reviewed in this IA are against an assumed baseline of full implementation. This baseline assumes that existing targets are all implemented in all Member States on time. Apart from measures taken to improve implementation such as improved statistics, promotion of economic instruments, improvement of the functioning of the EPR schemes, no additional changes in the legislation are included in this scenario.

3.0 Outline of Model Components

A full description of the mass flow model, together with technical documentation on the individual modules, can be found in the reporting documents that are being produced as part of the European Reference Model Project. The intention here is to summarise the model in context of the IA and explain how it was used to model the policy scenarios included in this document.

A schematic of the overall model is depicted in Figure 3-1. From this it can be seen that the main model calculations consists of six modules, or components, these include:

- Mass Flow Module – the central core of the model which accounts for all material flows at each level of the hierarchy and how they are treated/managed;

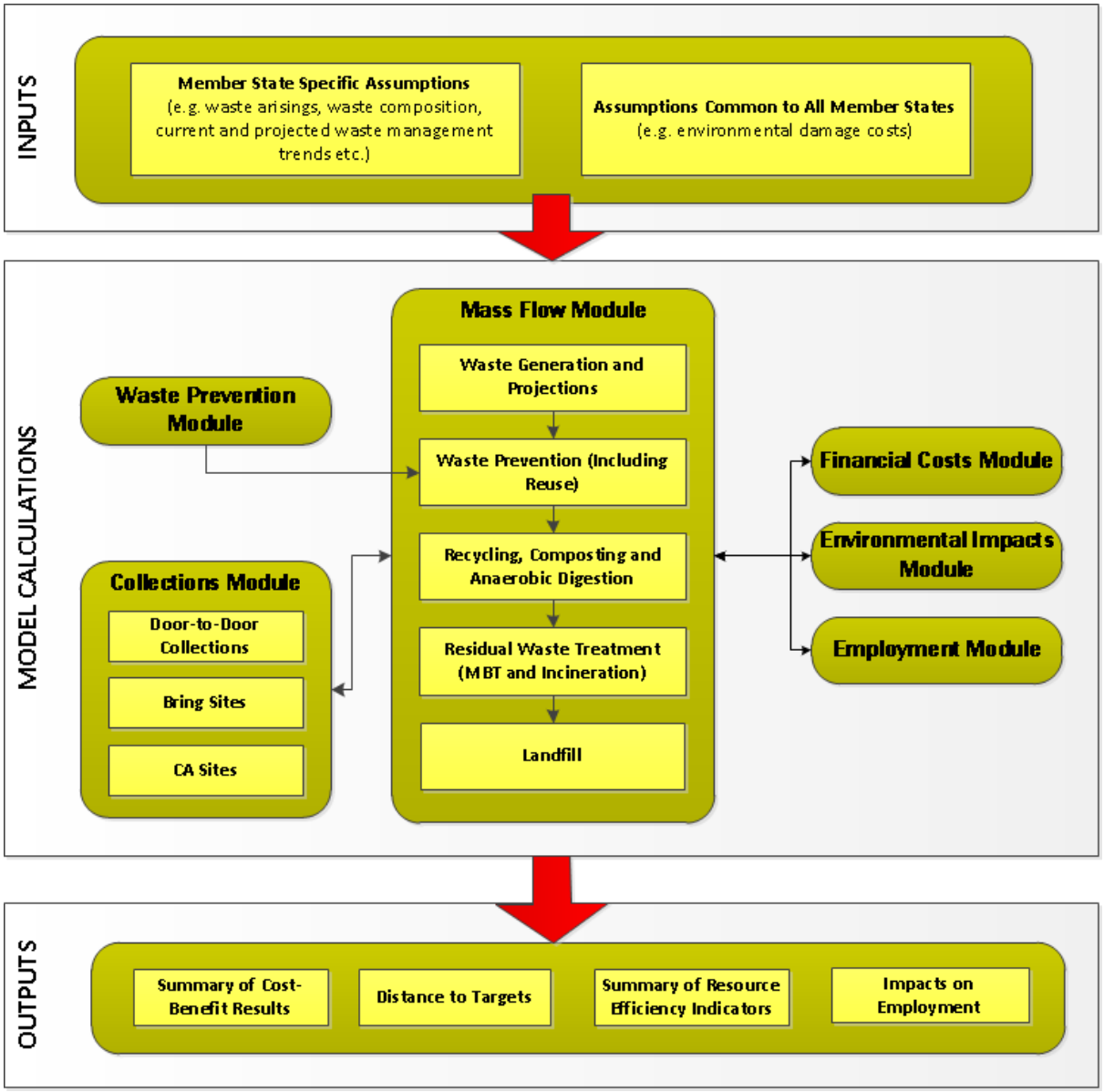
- Waste Prevention Module – this standalone module allows the impacts and implementation costs of various waste prevention initiatives to be calculated for Each Member State;
- Collections Module – this module is used to define how municipal waste is collected in each Member State and what the costs and logistics of this are;
- Financial Costs Module – this module, based on the mass flow of MSW, will calculate the costs of managing it via different pathways (e.g. via landfill, incineration and/or recycling);
- Environmental Impacts Module – this includes the modelling of both GHGs and local air emissions (direct and avoided emissions are monetised so as to compare directly with the financial costs); and
- Employment Module – this module is used to quantify the impacts that proposed policy changes will have on employment.

The outputs of the model are summarised in two separate modules and include the following:

- Summary of Cost-Benefit Analysis results;
- Assessment of the distance to European waste directive targets;
- Indicators relating to resource efficiency; and
- An evaluation of anticipated impacts on employment.

Each of the modules are introduced below with, as far as possible, important assumptions being highlighted to provide clarity on the approach that was taken.

Figure 3-1: Overall Model Schematic

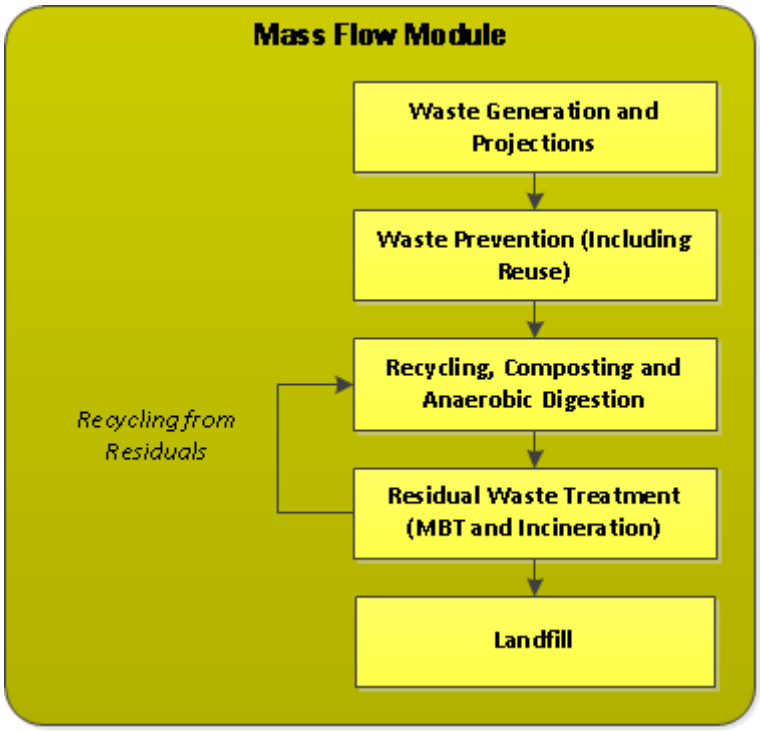


3.1.1 Mass Flow Module

A conceptual depiction of the mass flow model is given in Figure 3-2. The flow of waste within the excel model follows the principle of the waste hierarchy, and individual sheets are included in the model for recording tonnages generated and managed at each level of the hierarchy. For instance, the first modelling sheet lays out total generated municipal waste tonnages. The second sheet accounts for the impacts of any waste prevention initiatives that come out of the Waste Prevention Module (Section 3.1.2). All waste prevention impacts, assuming there are any, are then subtracted from the total projected amount of generated waste. The remaining waste is then collected for recycling, composting, and anaerobic digestion. All residual waste is available for residual waste treatment, notably incineration or mechanical and biological treatment (MBT). Note that these processes can extract additional materials for recycling and this is factored into the

calculations for recycling rates in the model. The remaining waste (rejects from recycling and residual treatment) and waste not subject to any treatment goes to landfill. Each of the levels of the Mass Flow Module are briefly introduced below.

Figure 3-2 Overview of the Mass Flow Module



A more detailed outline of the approach taken to the mass flow modelling is presented in Figure 3-3. The intention of the Mass Flow Module is to ensure that all tonnages of waste that are generated, are accounted for by the sum of the recovery and treatment pathways, including mass losses where relevant. There is also a clear distinction between mixed refuse and segregated waste collection, which provides greater clarity concerning the nature of the treatment of organic waste in particular.

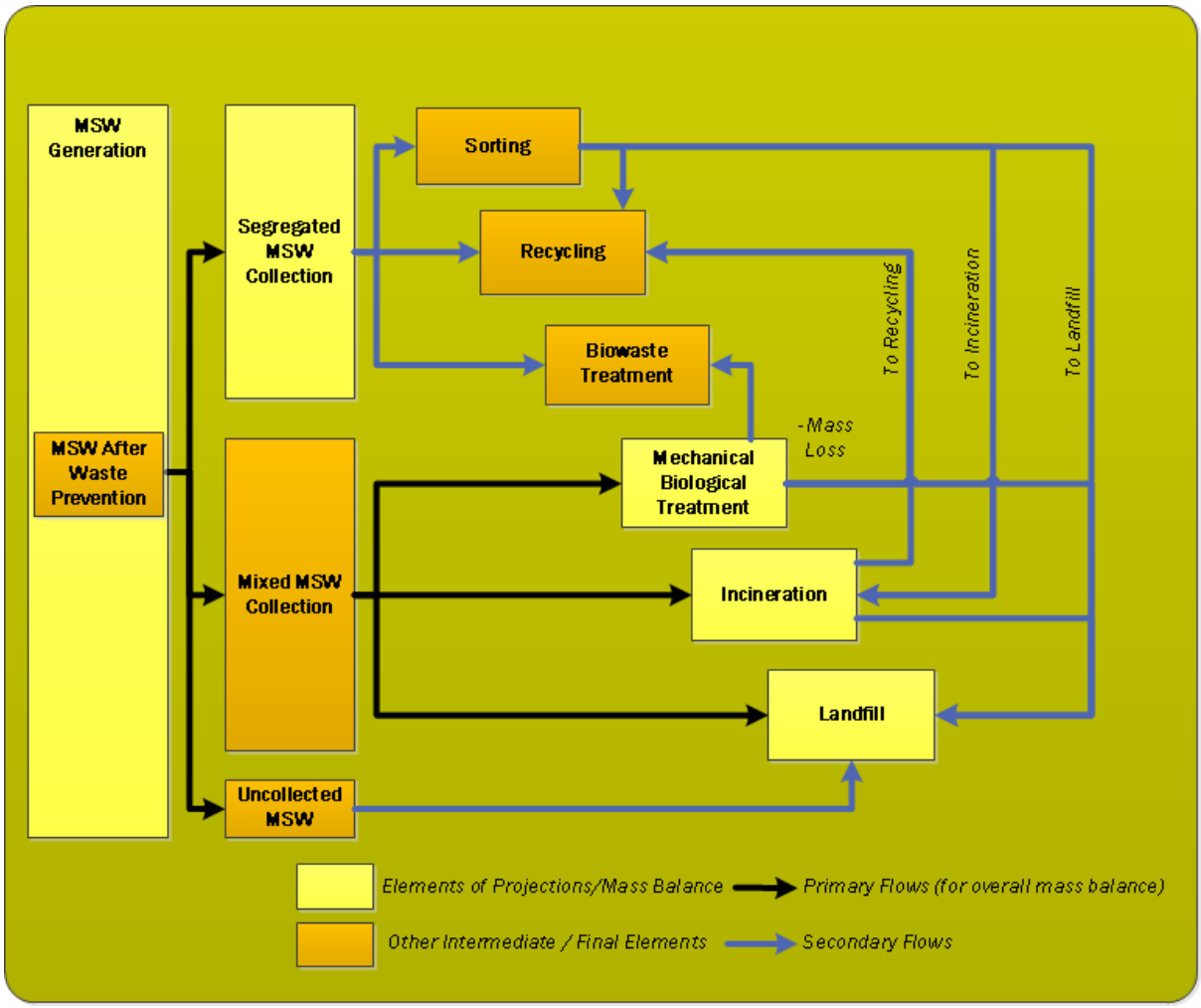
Clearly to operate a model with a more intricate flow of material as depicted by Figure 3-3, additional information is needed. Nevertheless, these additional pieces of information are needed for a model of this nature because:

a) Collection systems have related costs and impacts;

b) Treatment plants (including those considered by the current Eurostat Methodology as 'pre-treatment' plants) have related costs and impacts; and

c) All tonnages (including uncollected waste) need to be accounted for or the financial costs and environmental impacts will be incomplete and consequently flawed.

Figure 3-3: Approach Taken to Mass Flow Modelling



Note: Imports and Exports excluded from this presentation but intended to be accounted for in the model.

3.1.1.1 Waste Generation and Compositon

Waste Generation

As stated above each Member State (including Croatia) was contacted and asked to complete a questionnaire which was designed to obtain the necessary country specific information for input into the model. In terms of developing forward projections of MSW arisings for each Member State we used, where these were made available, projections that had been produced by the Member States themselves. In situations where Member States had not produced their own projections we produced independent projections based on the

2012 work by the ETC/EEA.[7] Full details of these projections can be found as a technical Annex in the report documents associated with the European Reference Model on Waste.[8]

Waste Composition

The model includes 51 fractions of MSW as indicated in Table 3-1. These fractions were selected following detailed consideration of:

- The available Member State compositional datasets;
- Requirements for reporting of data on specific materials to enable calculation of performance against the various European waste Directives; and
- Requirements for the model to perform distinct functions to meet the broader purposes and objectives for this model, i.e. the ability to model the environmental impact of the treatment of individual waste fractions.

Where Member States provided us with compositional breakdowns of their municipal waste stream we inputted this into the model based on the compositional breakdown shown in Table 3-1. Where information on composition could not be obtained directly from the Member State we used information obtained as part of research conducted by the ETC for the EAA in 2009.[9]

Table 3-1 Waste Fractions Included in the Model

Compositional Waste Fractions in the Model	
Biowastes	**Plastics (continued)**
Food	Non-packaging rigid plastics
Garden	Film packaging (bags etc)
Other biowastes	Non-packaging films
Wood	**WEEE**
Wood packaging	Large household appliances
Other wood	Small household appliances
Paper / Cardboard	IT and telecommunications equipment
Non-packaging paper	Consumer equipment and photovoltaic panels
Packaging paper	Lighting equipment
Cardboard	Electrical and electronic tools
Textiles	Toys, leisure and sports equipment
Clothing and footwear	Medical devices
Other textiles	Monitoring and control instruments
Glass	Automatic dispensers
Packaging glass	Rubble, soil
Non-packaging glass	Furniture

[7] ETC / EEA (2012b) *Revision of the MSW Generation Projection Equations Based on Additional Data Points for 2009 and 2010,* Prepared by Andersen, F. M. et al. in 2012

[8] Eunomia Research & Consulting and Copenhagen Resource Institute (in development) *Development of a Modelling Tool on Waste Generation and Management*, Report for the European Commission DG Environment, www.wastemodel.eu

[9] ETC/SCP (2009) *Europe as a Recycling Society - Present Recycling Levels of Municipal Waste and Construction & Demolition Waste in the EU*, Prepared by Christian Fischer and Mads Werge, Working Paper No 2/2009

Compositional Waste Fractions in the Model	
Metals	**Batteries and accumulators**
Mixed cans	Portable batteries
Steel cans	Accumulators
Aluminium cans	**Other wastes**
Aluminium foil	ELVs
Other scrap metal	Haz (exc WEEE)
Plastics	Fines
Plastic bottles	Inerts
Other rigid plastic packaging	Other

By multiplying the total waste arisings for each country by their MSW composition it is possible to come up with the projected waste arisings by material stream. This then feeds down into the lower tiers of the hierarchy as shown in Figure 3-2.

3.1.1.2 Waste Prevention

The Waste Prevention Module (see Section 3.1.2) allows a number of waste prevention initiatives to be modelled over the period 2010 to 2035 (e.g. food waste reduction programmes, the promotion of reusable nappies, and reducing unsolicited mail). The output from this module is a total waste prevention impact (in tonnes) for the selected range of waste prevention initiatives. This total tonnage is broken down by material and feeds directly into the waste prevention component of the Mass Flow Module. The prevented waste is then subtracted from the total amount of MSW generated to come up with a final projection of MSW arisings in each Member State.

The model recognises that not all MSW is managed by the formal sector. The model therefore requires that the 'collection coverage' be defined for each Member State. The larger the informal waste sector in a country the lower the collection coverage was assumed to be. In all countries with an informal sector it was assumed that the collection coverage improves over time (the point at which 100% coverage is achieved naturally varies from country to country).

For material that is not collected by the formal sector it was assumed that it goes to landfill. For all other waste – that is, waste managed by the formal sector – the model assumes that this is collected via official means and therefore is available for recycling, composting, and other forms of treatment and disposal.

3.1.1.3 Recycling, Composing, and Anaerobic Digestion

In order to split all formally collected MSW by the different tiers of the hierarchy the Mass Flow Module requires that current and future trends are defined for the following:

- Material recycling;
- Composting/anaerobic digestion;
- MBT;
- Incineration; and
- Landfill.

These inputs are defined as proportions of total waste arisings and are used to apportion the amount of waste that passes through each tier of the hierarchy presented in Figure 3-2.

In order to set up the baseline scenarios these parameters were defined for each Member State based on information that was made available through the detailed country questionnaire, face-to-face interviews, and a search of publically available documents (see Section 2.0 for a discussion of the baseline scenarios).

Data on current recycling and composting rates in the different Member States was largely obtained from Eurostat. However, in a few instances these rates were adjusted slightly after discussions with Member State representatives who were able to provide updated figures that had emerged since the figures had been reported to Eurostat. The amount of material collected for recycling and/or biotreatment in the future is determined by the projected trends in recycling rates.

The model is able to adjust the treatment share between in-vessel composting (IVC), open air windrow (OAW) and anaerobic digestion (AD). Different types of energy recovery from anaerobic digestion can also be modelled.[10]

3.1.1.4 Residual Waste Treatment

MBT

As stated above, the amount of MSW requiring treatment via MBT or incineration is determined by current levels of treatment and what is believed to be likely future trends. Mechanical biological treatment is a residual waste treatment, where mixed waste is sent to an integrated plant for mechanical treatment (separation, shredding) and a biological treatment. The biological treatment typically consists of mixed waste composting or more rapid 'biodrying' (for production of a fuel), and may also include an anaerobic digestion element. The outputs from MBT plants can go to a variety of sources:

- Recovered recyclables (e.g. metals and plastics can get recycled) can contribute to recycling rates;
- Refuse Derived Fuels (RDF) can be sent for incineration at EfW plants or cement kilns; and
- Stabilised or rejected waste can be sent to landfill.

The proportion of material which goes to each source can be assigned in the model based on the type of MBT facilities that are operating in each Member State. Five variants of MBT have been defined in the model. They include:

- MBT 1 – Biostabilisation;
- MBT 2 – Biodrying no plastics recycling;
- MBT 3 – Biodrying with plastics recycling;
- MBT 4 – AD based; and
- MBT 5 – Basic sorting + energy generation.

[10] The following AD energy recovery schemes are included in the model: electricity only; combined heat & power (CHP); gas to grid; and gas to vehicle fuel.

Assumptions concerning the level of recycling, RDF production, mass loss etc. are specific to the five types of MBT included in the model. Extraction rates from residual treatments for recycling are calculated as the ratio between output (for recycling etc.) and input for a given material.

Incineration

Four incineration variants have been included in the model:

- Incineration – Electricity only;
- Incineration – Combined Heat and Power (CHP);
- Incineration – Heat only; and
- Incineration – No energy recovery.

The proportion of residual waste going to each type of facility is defined for each Member State. The efficiency with which metals are recovered from incineration facilities is modelled based on a recent literature review undertaken by Grosso et al, which suggested that 70% of the ferrous metal could be recovered as well as 30% of the non-ferrous metal.[11] As shown in Figure 3-2, all recovered metals are taken out of the residual waste stream and added to the recycling stream where they count towards the overall recycling rate reported by the model.

3.1.1.5 Landfill

Landfilling is the final part of the waste management chain. This Mass Flow Module has been developed to ensure a mass balance between the MSW generated (after waste prevention has been taken into account) and the waste treatments outlined above.

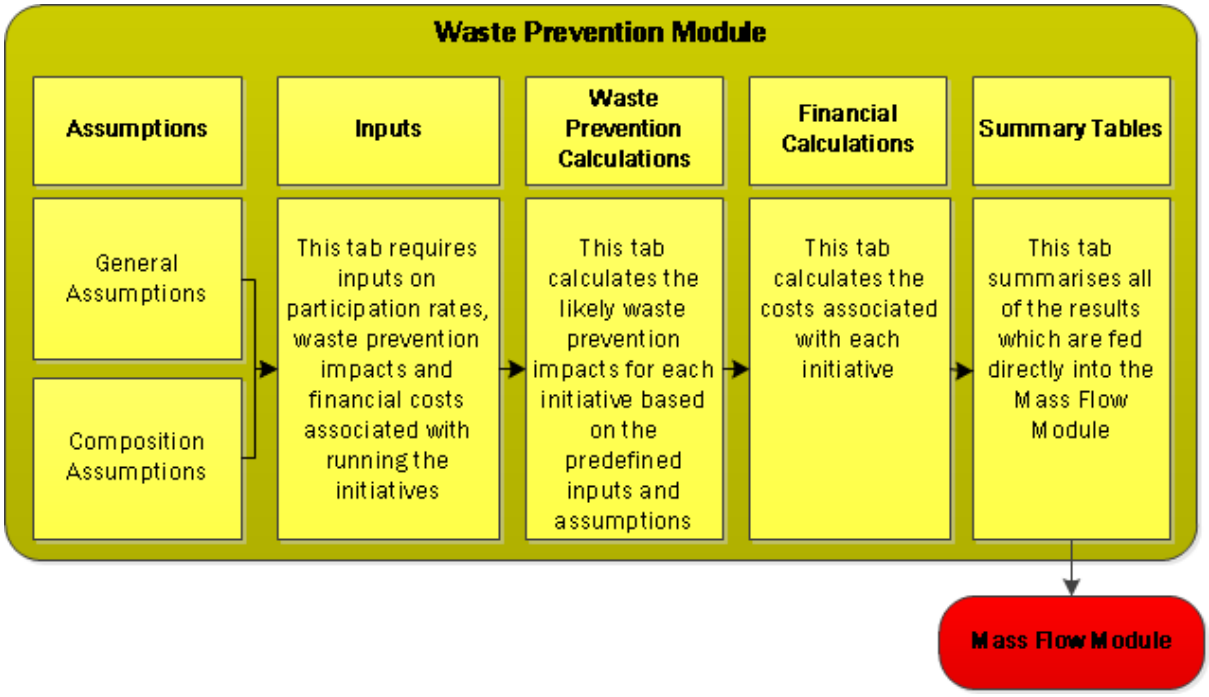
As discussed in Section 3.1.1.2, all uncollected waste is assumed to go to landfill. In addition, all the rejects from sorting facilities are assumed to be MSW sent to landfill and /or incineration. For this reason, the amount of waste landfilled calculated in the model may conservatively give a higher figure than amounts sent to landfill as reported by Eurostat.

3.1.2 Waste Prevention Module

An overview of the Waste Prevention Module is presented in Figure 3-4 which illustrates the model processes. From this it can be seen that user defined inputs, along with a number of assumptions, feed into the Waste Prevention and Financial Calculations sheets. These results are amalgamated in the Summary Tables. The results presented in the Summary Tables then feed directly into the waste prevention component of the Mass Flow Module.

[11] Grosso M, Biganzoli L and Rigamonti L (2011) A Quantitative Estimate of Potential Aluminium Recovery from Incineration Bottom Ashes, Resources, *Conservation and Recycling*, Vol. 55, pp. 1178-1184

Figure 3-4: Overview of the Waste Prevention Module



The Waste Prevention Module allows for the waste prevention impact and financial cost of the following initiatives to be calculated:

- Home composting;
- Say no to unsolicited mail;
- Promotion of reusable nappies;
- Door stepping campaign promoting the prevention of food waste;
- Media based campaign promoting the prevention of food waste;
- Campaign to promote General Waste prevention initiatives;
- Paint reuse at bring sites;
- Community swap days;
- Reducing the size of residual waste containers;
- No side waste policies;
- Pay as you throw; and
- 'Other' initiative.

The waste prevention impact of any initiative depends on two factors:

1. The number of people/households participating; and
2. The amount of waste prevented by each participant.

Each initiative uses the above logic to calculate the amount of waste that is likely to be prevented if it were to be implemented. Naturally, the number of participants involved and the amount of waste prevented will depend on a number of factors, for example, the type of initiative, the socioeconomic demographic of the target population and the degree to which an initiative is promoted by the authorities. As such, careful consideration needs to be given to the inputs in this section to ensure that they are in alignment with the amount of funding that is made available to promote the initiative, and to ensure that the amount

of waste prevented per participating household/person is realistic for the country being modelled.

As stated above and shown in Figure 3-4, the waste prevention impacts arising from the implementation of these initiatives feed through into the Mass Flow Module. For the sake of brevity further details and assumptions will not be outlined here, instead the reader is referred to the documentation that accompanies the European Reference Model on Waste.

3.1.3 Collections Module

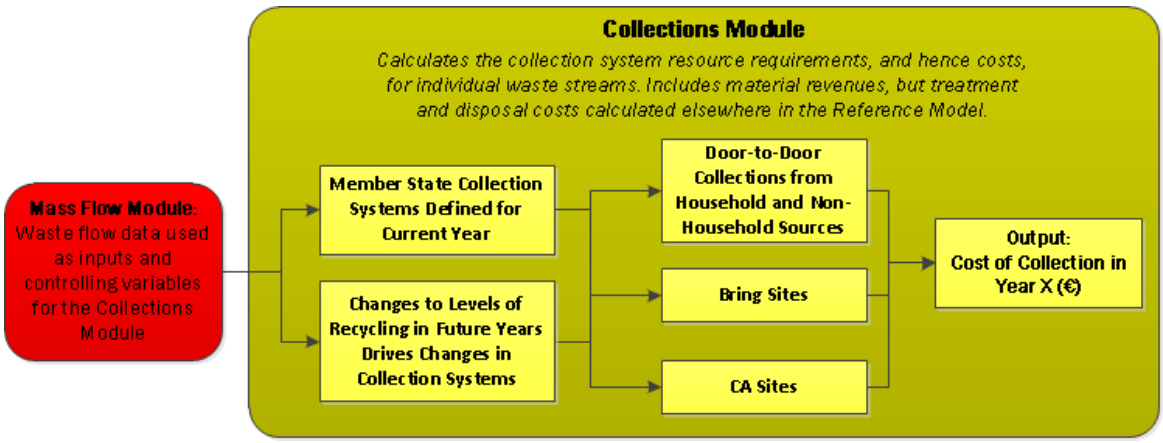
The Collection Cost Module provides two core functions for the European Reference Model. In the first instance it allows current collection systems for any country to be defined in the model, and for the associated collection costs to be calculated. It then allows the user to consider what changes to collection systems might be required if ambition for recycling is to change, and what would be the associated costs of service change.

A broad categorisation of collection system types operated within Member States can be given as follows:

- Door-to-door (D2D) collections;
- Bring sites; and
- Civic amenity (CA) sites (sometimes also referred to as recycling centres).

The collection cost model covers all three of these collection systems, each of which may collect a range of recyclables, organic wastes, or mixed residual waste. A diagrammatic representation of the Collections Module is provided in Figure 3-5.

Figure 3-5: Overview of the Collections Module



The Mass Flow Module's tonnages of mixed and segregated MSW are used as an input to the Collections Module. This provides the core information on levels of current and future collected recycling.

Currently operated Member State collection systems are defined in the model in the first instance by the consultant team using information gathered during the consultation phase of the model development. These systems are described in more detail in the documentation accompanying the model. The resource requirement for the collection

operations (numbers of vehicles, containers, staff etc.) are calculated by the model. These resource requirements generate a cost of collection for recent systems.

Collection system costs for future years relate to the recycling rate to be achieved in the respective year. The model automatically moves a country from one collection system to another, depending on the recycling rate to be achieved. The costs of the mix of collection systems to be operated in future years are thereby calculated. This gives a profile of collection costs for each Member State as collection systems may evolve over time to satisfy future recycling ambitions.

The model also assumes that the values shown in **Error! Reference source not found.** are derived from the sale of the core materials collected and sorted (as necessary) for recycling. These values are indicative of those generated over recent years. It goes without saying that these fluctuate over time. It should also be noted that the model allows for deduction from this value to indicate the cost of haulage (to end markets) of the different materials.

Table 3-2: Material Values Assumed in the Collections Module

Material	Revenue (€/kg)
Paper	€ 0.118
Card	€ 0.106
Paper & Card	€ 0.095
Textiles	€ 0.296
Glass	€ 0.024
Steel	€ 0.166
Aluminium	€ 0.887
Metals	€ 0.310
Plastics	€ 0.118
Other	€ 0.059

3.1.4 Financial Costs Module

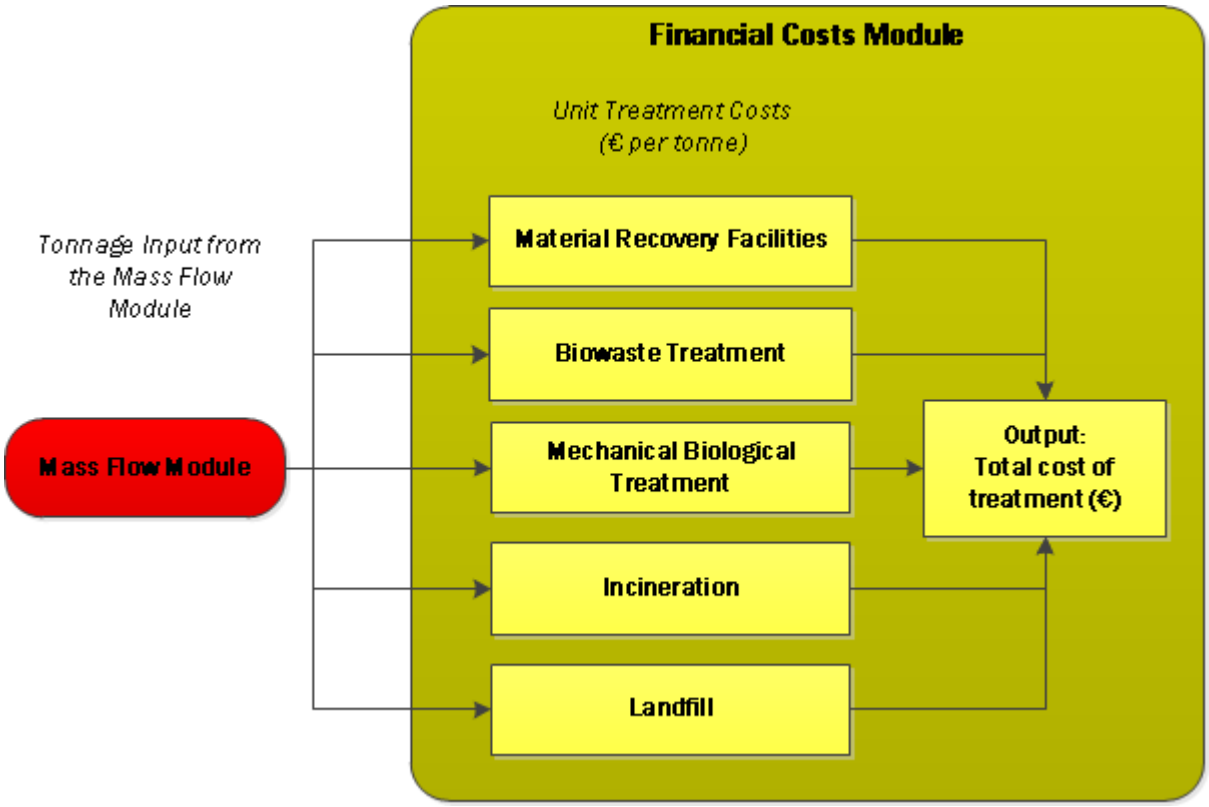
As part of the modelling exercise we have sought to make financial cost estimates as country-specific as possible. There are some limits as to how much detail can be developed in this respect, but the approach gives, we believe, a sensible compromise between the desirability of generating country specific cost data, and the difficulties experienced in finding country specific cost figures.

Consequently, for modelling individual waste collection and treatment process we have tended to fall back on data for which we have sound knowledge of the breakdown in costs, and have sought to adapt that to the specific Member State situation through varying specific cost factors to reflect local markets (for example labour), and with various taxes (for example on landfill) and subsidies (for example feed-in-tariffs for renewable energy).

We have attempted to research and use up to date figures for Member State specific data, but specific figures may have changed since the time of writing.[12] The following subsections lay out the generic approaches and assumptions used in the financial cost modelling which are not specific to individual treatments (for example the financial cost terminology, the cost of finance, revenues from energy sales, labour rates in individual member states etc.).

An overview of the module is presented in Figure 3-6. A summary of the unit costs of treating a tonne of waste via each of the treatment technologies listed in this figure is presented at the end of this section in Table 3-10. In essence, the tonnage output from the Mass Flow Module is multiplied by the calculated unit cost of treatment and/or disposal to come up with a final cost. Some of the assumptions pertaining to how these unit costs are described here, with further details being provided as part of the technical documentation that is being produced as part of the modelling project.

Figure 3-6: Overview of the Financial Costs Module



3.1.4.1 Note on Costs with Regard to Gate Fees

Where matters of cost are concerned, the waste sector is typically used to dealing with the issue in terms of 'gate fees'. Gate fees are not 'costs', and there are various reasons why the gate fee at a facility may differ from costs, as they might be conventionally understood. Gate fees may, depending upon the nature of the treatment, be affected by, inter alia:

[12] Prices taken as 2012 figures, accepting that financial years have different start and end points. An approximation is taken where data comes from countries like the UK where the financial year runs from April to end March (in this case UK 2012/13 prices are taken in the model as 2012 prices).

1. Local competition (affected by, for example, haulage costs);
2. Amount of unutilised capacity available at facilities;
3. The desire to draw in, or limit the intake of, specific materials in the context of seeking a specific feedstock mix;
4. Strategic objectives of the facility operator; and
5. Many other factors besides.

Any one of these can influence the market price, or gate fee, for a service offered by a waste management company.

Another feature of the waste treatment market is the use of long-term contracts in the municipal waste market to procure services where the private sector is involved. The nature and length of these contracts, and the nature and extent of the risks which the public sector may wish to transfer to the private sector, influences the unitary payment, or gate fee, offered under any given contract. The nature of risk transfer may relate, for example, to technology and its reliability, or to specific outputs which a contract seeks to deliver (e.g. energy, materials), and these may, in turn, relate to existing policy mechanisms.

The key point is that the nature of the risk transfer associated with a given contract affects gate fees. In the municipal waste sector, contract prices may typically be wrapped up in the form of a single payment, which may be composed of a number of different elements associated with the delivery of the contract against the specified outputs. This 'unitary payment' is typically determined on a contractual basis, and so is somewhat different to gate fees which might be realised at facilities operating in a more openly competitive market. In the approach used in this study, issues of risk transfer are not considered.

It should also be noted that whilst some of the major items of infrastructure for treating municipal waste have been financed using project finance, it remains possible that corporate finance could be used to support projects, or that public funding could be available to fund projects. This would have the effect of changing the cost of capital used to support any given project.

Generally, therefore, the costs we have developed will be different to 'gate fees' or payments which may be experienced in a given contractual agreement, or spot market transaction, though they will approximate to them in competitive markets which are not characterised by over-supply of capacity of one or other type.

It should also be recognised that different treatments are more and less sensitive to variables which underpin the analysis of costs. For example, changes in the cost of capital affect the unit (per tonne) cost of more capital intense treatments in a more significant way than is the case for those processes with lower unit capital costs (such as waste collection). Similarly, assumptions concerning landfill taxes, and levels of support for renewable energy outputs will affect different treatments in different ways. Value added taxes, on the other hand, are not typically charged on waste equipment and operations, and do not therefore appear in the model.

3.1.4.2 Accounting Principles and the Cost Metrics Included in the Model

The model is intended both as a tool to indicate the financial implications within the waste industry of changes in waste management, as well as calculating the net costs and benefits including (as far as possible) environmental impacts. For the former, the model calculates costs under a *'private metric'* (reflecting the costs as discussed in Section 3.1.4.1 above). For the latter, a *'social metric'* is used. Additionally, a *'hybrid'* between the two metrics is included to indicate the level of actual economic activity in the waste sector. The three metrics can be defined as follows:

- The **'Private Metric'** is intended to represent the market conditions from the perspective of those undertaking waste operations or those developing and operating facilities. It uses retail prices, includes taxes and subsidies, and applies a weighted average cost of capital (WACC, typically 10-15%) to capital equipment. Taking a treatment facility as an example, this approach essentially indicates an approximate 'break even' gate fee, inclusive of taxes, at a level where the facility would cover its capital and operating costs under typical market conditions.
- The **'Social Metric'**, on the other hand, is appropriate for use in cost benefit analyses and impact assessments attempting to calculate an overall cost to society. This metric uses the European Commission's standard 4% discount rate for inter-temporal comparisons within impact assessments.[13] Subsidies and taxation are also stripped away so as to only value the true *'resource cost'* of an activity. This also avoids any double counting of environmental effects that are intended to be internalised within environmental taxes and subsidies. Under this metric, environmental damage costs can be added to, the financial costs so as to determine, for instance, whether the impact of a policy is positive or negative with respect to society.
- The **'Hybrid Metric'** is essentially to attempt to put a measure on the economic activity within the municipal waste sector. To summarise the approach, it values capital investments in the same way as the private metric, but excludes all taxes and subsidies.

The net present value of any future investments or contextual changes in the waste sector uses the Commission standard 4% discount rate (the social rate of time preference), no matter which approach is considered.

All costs are calculated and displayed in real terms at 2012 prices in the model, using the EU average GDP deflator for historic years (as shown in Table 3-3) or the European Central Bank price stability target for future years (*"below but close to 2% over the medium term"*)[14].

[13] European Commission (2009) *Impact Assessment Guidelines*, 15 January 2009, SEC (2009) 92.

[14] European Central bank Website (Accessed 11/6/2013), , Monetary Policy > Strategy > Definition of price stability http://www.ecb.int/mopo/strategy/pricestab/html/index.en.html

Table 3-3: Historic and Future GDP Deflators Used in the Model

2004	2005	2006	2007	2008	2009	2010	2011	2012	Future years
2.7%	1.9%	2.3%	2.9%	0.4%	-1.6%	2.4%	0.8%	3.1%	2%

Source: Eurostat mid year (Q3) seasonally adjusted price index (percentage change compared to corresponding period of previous year, based on 2005=100 and national currency (including 'euro fixed' series for euro area countries). Data for the European Union (27 countries) and Croatia. Gross domestic product at market prices. Eurostat online database, GDP and main components - Price indices [namq_gdp_p] accessed 11/6/2013.

3.1.4.3 Disposal Taxes

The current taxes for landfill and incineration for each Member State are shown in Table 3-4. These figures are compiled from a range of sources, with data from the 2012 ETC/SCP source[15] taking precedence, where available, over other data from more disparate and historic sources.

[15] ETC/SCP (2012) Overview of the Use of Landfill Taxes in Europe, prepared by Christian Fischer, Mathias Lehner and David Lindsay McKinnon of the Copenhagen Resource Institute, April 2012 http://scp.eionet.europa.eu/publications/WP2012_1/wp/WP2012_1

Table 3-4: Taxes on Landfill and Incineration by Member State (prices in nominal terms)

Member State	Landfill Tax - Municipal (€/tonne)						Other waste taxes (€/tonne) 2012 prices unless otherwise indicated			
	2010	2011	2012	2013	2014	2015+	Hazardous disposal*	Incineration tax	MBT residues	Incineration residues
Austria	€ 87.00	€ 87.00	Ban on landfilling of untreated waste from Jan 2012. Landfill via MBT only (tax applied as shown to right)				€ 29.80	€ 8.00	€29.80	
Belgium - Flanders	€ 79.56	€ 79.56	€ 79.56	€ 79.56	€ 79.56	€ 79.56		€ 7 (2008)		
Belgium - Wallonia	€ 65.00 [indexed]	€ 65.52	€ 67.55	€ 68.90	€ 70.28	€ 71.69	As landfill	€ 8.00		€12.50
Belgium - Brussels	No data, assume all exported to other two regions at their respective rates of tax									
Belgium - weighted	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC		TBC
Bulgaria	€ 1.53	€ 1.53	€ 4.00	€ 8.00	€ 18.00	€ 18.00				
Cyprus										
Czech Republic	€ 20.00	€ 20.00	€ 20.00	€ 20.00	€ 20.00	€ 20.00	€ 68.00 (2011)			
Denmark	€ 63.00	€ 63.00	€ 63.00	€ 63.00	€ 63.00	€ 63.00	€ 21.30[16]	€ 44.00 (2008)**		
Estonia	€ 12.00	€ 12.00	€ 12.00	€ 12.00	€ 12.00	€ 12.00	€ 12.00 (2010)	€ 7.00		
Finland	€ 30.00	€ 40.00	€ 40.00	€ 50.00	€ 50.00	€ 50.00				
France	€ 20.00	€ 20.00	€ 30.00	€ 30.00	€ 30.00	€ 40.00	€ 20.00 (2010)	€ 11.20[17]		
Germany										
Greece										
Hungary										

[16] Rising to €63.00 in 2015

[17] Rising to €14 from 2013

Member State	Landfill Tax - Municipal (€/tonne)						Other waste taxes (€/tonne) 2012 prices unless otherwise indicated			
	2010	2011	2012	2013	2014	2015+	Hazardous disposal*	Incineration tax	MBT residues	Incineration residues
Ireland	€ 30.00	€ 50.00	€ 65.00	€ 75.00	€ 75.00	€ 75.00				
Italy	€ 30.00	€ 30.00	€ 30.00	€ 30.00	€ 30.00	€ 30.00	€ 5.16 – € 25.82			
Latvia	€ 4.27	€ 7.11	€ 9.96	€ 9.96	€ 9.96	€ 9.96	€ 21.34			
Lithuania	€ 22.00	€ 22.00	€ 22.00	€ 22.00	€ 22.00	€ 22.00				
Luxembourg										
Malta										
Netherlands	Previously €107.00 but abolished in January 2012									
Poland	€ 26.60	€ 26.60	€ 26.60	€ 26.60	€ 26.60	€ 26.60				
Portugal	€ 4.00	€ 4.00	€ 4.00	€ 4.00	€ 4.00	€ 4.00	€ 6.00 (2011)	€ 1.07 (2011)		
Romania										
Slovakia										
Slovenia	€ 11.00	€ 11.00	€ 11.00	€ 11.00	€ 11.00	€ 11.00	€ 22.00 (2010)			
Spain - Catalan only	€ 10.00	€ 12.00	€ 12.00	€ 12.00	€ 12.00	€ 12.00		€ 5.50 (2011)		
Spain - remainder										
Spain - weighted	TBC	TBC	TBC	TBC	TBC	TBC		TBC		
Sweden	€ 47.00	€ 47.00	€ 47.00	€ 47.00	€ 47.00	€ 47.00	€ 47.00			€47.00
United Kingdom	€ 57.60	€ 67.20	€ 76.80	€ 86.40	€ 96.00	€ 96.00			As landfill	€3.13
Croatia										

Notes:

- **Hazardous disposal tax applied in the modelling to incineration air pollution control residues.*
- ***Source: Fischer (2008) The use of landfill and incineration waste taxes in selected EU countries, Presentation for the European Environment Agency, April 2008, http://www.ea-swmc.org/download/CBPII/Landfill%20and%20%20incineration%20taxes170408.pdf*

- *In Italy, prior treatment by Incineration and MBT leads to a discount in landfill tax, but this is not specified and varies in value so has not been included in the modelling. For hazardous disposal we take an average value of €15.50/tonne.*
- *For Spain, relevant taxes on municipal waste are only known to be charged in Catalonia.*[18] *Within the modelling for Spain, we multiply the tax by the current relative quantity of waste originating from Catalonia by the total for Spain as a whole. A higher landfill tax rate (€21/tonne) is payable in Catalonia if the municipality does not operate separate biowaste collection. As of 2010, however, at least 692 of the 947 municipalities of Catalonia had implemented separate biowaste collection, and this number continues to increase. As such, the assumption going forward for the financial modelling is that the lower rate applies.*
- *For Belgium, rates are different in Flanders, Wallonia and the Brussels Capital Region. Once again, a weighting is conducted across the three regions depending on arisings from one to the other. We note that any waste generated within Flanders attracts the Flanders taxes even if shipped for treatment or disposal outside the region.*
- *UK prices converted at €1.2 per pound*.

[18] Ignasi Puig Ventosa (2011) *Landfill and Waste Incineration Taxes: The Spanish Case*, Presentation at Brussels 25th October 2011, ec.europa.eu/environment/waste/pdf/strategy/5.%20Landfill%20and%20incineration%20taxes%20in%20Spain%20Ignasi%20Puig%20%282%29.pdf

3.1.4.4 Revenue from Electricity Sales

Ideally it would be possible to accurately establish, for each Member State, the wholesale prices that generators would receive for the electricity they produce. However, this process is complicated due to a number of factors. The first of these is the lack of properly developed and integrated wholesale markets within the EU. Ultimately, there may be a single European energy market with a single wholesale price at any one time, but currently the market is fragmented, and in a number of cases, such as Romania and Bulgaria, prices are set by the Government regulator. Where wholesale markets do exist, and data is available, it is not clear what proportion of this price would be received by the generator, and how much might be taken by the supplier.

As a proxy, we have used, as a first step, Eurostat's most recent half-yearly electricity prices, without taxes, for industrial consumers.[19] These values are shown in Table 3-5.

Table 3-5: Prices for Electricity for Industrial Consumers in each Member State (2012)

Member State	Revenue from Electricity Sales (€/MWh)	Member State	Revenue from Electricity Sales (€/MWh)
Austria	€ 88.80	Latvia	€ 111.00
Belgium	€ 96.10	Lithuania	€ 114.00
Bulgaria	€ 76.60	Luxembourg	€ 97.00
Cyprus	€ 226.20	Malta	€ 180.00
Czech Republic	€ 101.70	Netherlands	€ 85.50
Denmark	€ 85.60	Poland	€ 90.70
Estonia	€ 68.20	Portugal	€ 99.20
Finland	€ 67.30	Romania	€ 82.80
France	€ 63.20	Slovakia	€ 122.70
Germany	€ 87.80	Slovenia	€ 86.60
Greece	€ 102.80	Spain	€ 113.80
Hungary	€ 101.70	Sweden	€ 77.00
Ireland	€ 136.70	United Kingdom	€ 115.60
Italy	€ 143.80	Croatia	€ 93.30

Source: Eurostat

In using prices for one of the larger groups of industrial users (country specific prices become increasingly sparse when looking at the largest consumers), and stripping out taxes, it is expected that the prices are a reasonable, if slightly elevated, reflection of the variations in wholesale prices between Member States. While these figures may not accurately represent the wholesale price, they have the benefit of having been gathered using a standard methodology.

We then adjust these figures to represent an assumed differential between wholesale prices and prices for industrial consumers, and a further differential between wholesale

[19] Eurostat (2012) Energy Statistics Database (data are for 2012 S2, industrial consumers) available at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_pc_205&lang=en Accessed 12/6/12

prices and the prices that a generator would receive. We assume the price received by generators to be 60% of the price for large industrial consumers, giving the data in Table 3-6.

Table 3-6: Assumed Electricity Revenues for Generators in each Member State

Member State	Revenue from Electricity Sales (€/MWh)	Member State	Revenue from Electricity Sales (€/MWh)
Austria	€ 53.28	Latvia	€ 66.60
Belgium	€ 57.66	Lithuania	€ 68.40
Bulgaria	€ 45.96	Luxembourg	€ 58.20
Cyprus	€ 135.72	Malta	€ 108.00
Czech Republic	€ 61.02	Netherlands	€ 51.30
Denmark	€ 51.36	Poland	€ 54.42
Estonia	€ 40.92	Portugal	€ 59.52
Finland	€ 40.38	Romania	€ 49.68
France	€ 37.92	Slovakia	€ 73.62
Germany	€ 52.68	Slovenia	€ 51.96
Greece	€ 61.68	Spain	€ 68.28
Hungary	€ 61.02	Sweden	€ 46.20
Ireland	€ 82.02	United Kingdom	€ 69.36
Italy	€ 86.28	Croatia	€ 55.98

Source: 60% of data in Table 3-5

These values represent the back stop position for sale of electricity to the grid within the modelling, and the revenue that may be derived under the social or hybrid accounting metrics. Price support mechanisms are also often relevant for generation of electricity when calculated under the private metric, and are discussed further in Section 3.1.4.5.

3.1.4.5 Levels of Support for Renewable Electricity

For reasons outlined in the technical annex on financial costs that accompanies the EU waste model, some caution needs to be applied in the interpretation of data on renewable support mechanisms. Furthermore, the very nature and level of support mechanisms in EU countries is in a considerable state of flux, and are unlikely to remain stable in future years. The impact of the Renewable Energy Directive, setting even more ambitious targets for the proportion of electricity to be generated by renewables is likely to promote a revision of schemes across the EU.[20] The values used for the modelling are shown in Table 3-7, though the value applied in the calculation of prices under the private metric are the greater of either this data or the data in Table 3-6.

[20] Directive 2009/28/EC. Available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF

Table 3-7: Levels of Support for Renewable Electricity Identified for each Member State - 2012 figures

Member State	Renewable Electricity Support – Landfill Gas (€/MWh)	Renewable Electricity Support – Incineration (€/MWh)	Renewable Electricity Support – Anaerobic Digestion (€/MWh)
Austria	€ 5.00	-	€ 130.00
Belgium	€ 90.00	-	€ 90.00
Bulgaria	€ 115.00	-	€ 205.00
Cyprus	€ 114.50	-	€ 135.00
Czech Republic	€ 110.00	-	€ 110.00
Denmark	€ 110.00	-	€ 110.00
Estonia	€ 53.70	-	€ 53.70
Finland	€ 83.50	-	€ 83.50
France	€ 97.45	-	€ 81.21
Germany	€ 58.90	-	€ 60.00
Greece	€ 99.45	-	€ 200.00
Hungary	€ 110.00	€ 119.69	€ 50.00
Ireland	€ 81.00	-	€ 100.00
Italy	€ 140.00	-	€ 140.00
Latvia	€ 75.48	-	€ 75.48
Lithuania	€ 120.00	-	€ 120.00
Luxembourg	€ 120.00	-	€ 120.00
Malta	-	-	-
Netherlands	€ 70.00	-	€ 70.00
Poland	€ 63.58	-	€ 63.58
Portugal	€ 102.00	-	€ 115.00
Romania	€ 54.00	-	€ 27.00
Slovakia	€ 93.08	-	€ 144.88
Slovenia	€ 66.17	-	€ 129.15
Spain	€ 88.70	-	€ 88.70
Sweden	€ 23.20	-	€ 23.20
United Kingdom	€ 111.04	-	€ 111.04
Croatia	-	-	€ 159.00

Main source: Res Legal (2013) Legal sources on renewable energy, accessed 28/4/2013, http://www.res-legal.eu/en/search-by-country/
Additional sources:
http://www.schoenherr.eu/news-publications/legal-insights/bulgaria-the-energy-regulator-announced-the-new-feed-in-tariff-and-the-available-grid-for-renewable-energy-projects-in-bulgaria-for-2012-2013

3.1.4.6 Levels of Support for Renewable Heat

In the absence of a well-developed market for renewable heat, and the associated lack of up-to-date figures, we note that caution must be exercised in the interpretation of the figures applied in relation to renewable heat sales. The values used for the modelling are shown in Table 3-8.

Table 3-8: Revenue from Heat Sales in Member States - 2012 figures

Member State	Revenue from Heat Sales (€/MWh)	Member State	Revenue from Heat Sales (€/MWh)
Austria	€ 62.04	Latvia	€ 36.16
Belgium	€ 47.94	Lithuania	€ 36.16
Bulgaria	€ 25.34	Luxembourg	€ 47.94

Member State	Revenue from Heat Sales (€/MWh)	Member State	Revenue from Heat Sales (€/MWh)
Cyprus	€ 0.00	Malta	€ 0.00
Czech Republic	€ 41.67	Netherlands	€ 47.94
Denmark	€ 72.49	Poland	€ 32.05
Estonia	€ 25.25	Portugal	€ 0.00
Finland	€ 34.32	Romania	€ 24.42
France	€ 49.31	Slovakia	€ 36.20
Germany	€ 57.60	Slovenia	€ 37.45
Greece	€ 0.00	Spain	€ 0.00
Hungary	€ 38.98	Sweden	€ 56.60
Ireland	€ 27.53	United Kingdom	€ 27.53
Italy	€ 69.42	Croatia	€ 37.45

3.1.4.7 Labour Cost Ratios Between Member States

The costs of labour, taxes and social security and associated rates used in the modelling are shown in Table 3-9. These are used to proportionally weight the labour related costs associated with the individual technologies which are included in the model.

Table 3-9: Labour Costs Used as Ratios Between Member States

	Mean Net Annual Earnings €	Tax rate (% of salary)	Social Security and other labour costs paid by employer (% of total labour costs)	Mean Gross Annual Earnings €
Austria	€ 35,653	21%	26%	€ 67,359
Belgium	€ 42,850	26%	29%	€ 95,117
Bulgaria	€ 4,009	21%	18%	€ 6,538
Cyprus	€ 26,552	0%	12%	€ 30,304
Czech Republic	€ 11,206	14%	25%	€ 18,404
Denmark	€ 54,524	35%	11%	€ 102,392
Estonia	€ 10,089	16%	25%	€ 16,965
Finland	€ 38,920	18%	24%	€ 67,150
France	€ 31,207	18%	30%	€ 60,373
Germany	€ 36,997	30%	22%	€ 78,152
Greece	€ 25,398	16%	0%	€ 30,236
Hungary	€ 9,403	24%	28%	€ 19,428
Ireland	€ 35,321	6%	23%	€ 49,980
Italy	€ 29,766	21%	30%	€ 60,341
Latvia	€ 8,086	29%	21%	€ 16,172
Lithuania	€ 6,935	17%	27%	€ 12,480
Luxembourg	€ 51,197	15%	13%	€ 70,920
Malta	€ 25,398	8%	14%	€ 32,903
Netherlands	€ 42,567	22%	23%	€ 76,794
Poland	€ 9,988	22%	16%	€ 16,230
Portugal	€ 15,884	14%	18%	€ 23,390
Romania	€ 5,415	26%	21%	€ 10,254

Slovakia	€ 9,609	13%	25%	€ 15,461
Slovenia	€ 20,218	23%	14%	€ 31,950
Spain	€ 27,802	9%	27%	€ 43,441
Sweden	€ 36,314	20%	29%	€ 70,240
United Kingdom	€ 34,434	20%	12%	€ 50,750
Croatia*	€ 9,403	18%	16%	€ 14,269

Sources:
Tax and social security rates from Deloitte (2012) Tax Highlight 2012 Slovenia, http://www.deloitte.com/assets/Dcom-Global/Local%20Assets/Documents/Tax/Taxation%20and%20Investment%20Guides/2012/dttl_tax_highlight_2012_Slovenia.pdf
Labour rates from Eurostat *http://epp.eurostat.ec.europa.eu/portal/page/portal/labour_market/earnings*
Note: Croatia not included in this dataset so assume earnings as for Hungary which has similar GDP per capita.

3.1.4.8 Summary of Country Specific Costs for Waste Treatments

Table 3-10 presents draft country specific costs for the various waste treatments for each Member State under the private cost metric (i.e. including all taxes and revenues, and using the higher costs of capital). Details on how these costs were derived can be found in the technical appendix on financial costs which accompanies the model.

Table 3-10: Member State Specific Waste Treatment Costs Summary (2012 prices)

Total Unit Treatment Costs: Private Metric	Composting/Digestion				Incineration				MBT				Landfill
	Open Air Composting	In-Vessel Composting	Anaerobic Digestion	Electric Only	CHP	Heat Only	Combustion Only	Bio-stabilisation	Biodrying with no Plastics	Biodrying with Plastics Recycling	AD based MBT	Residual MRF + Combustion	
Austria	€ 30	€ 50	€ 64	€ 107	€ 117	€ 30	€ 90	€ 110	€ 95	€ 91	€ 95	€ 68	€ 124
Belgium	€ 30	€ 50	€ 80	€ 111	€ 129	€ 56	€ 96	€ 109	€ 98	€ 94	€ 98	€ 69	€ 108
Bulgaria	€ 24	€ 43	€ 26	€ 90	€ 115	€ 61	€ 70	€ 62	€ 71	€ 68	€ 71	€ 47	€ 30
Croatia	€ 24	€ 43	€ 40	€ 87	€ 108	€ 47	€ 73	€ 64	€ 73	€ 69	€ 73	€ 49	€ 33
Cyprus	€ 25	€ 44	€ 51	€ 41	€ 95	€ 100	€ 73	€ 70	€ 77	€ 73	€ 77	€ 52	€ 42
Czech Republic	€ 25	€ 44	€ 55	€ 86	€ 106	€ 43	€ 75	€ 69	€ 75	€ 71	€ 75	€ 51	€ 44
Denmark	€ 30	€ 49	€ 76	€ 151	€ 155	€ 58	€ 131	€ 106	€ 98	€ 94	€ 98	€ 69	€ 97
Estonia	€ 25	€ 44	€ 70	€ 97	€ 121	€ 65	€ 74	€ 72	€ 76	€ 72	€ 76	€ 51	€ 51
Finland	€ 27	€ 47	€ 74	€ 105	€ 125	€ 59	€ 80	€ 86	€ 87	€ 83	€ 87	€ 60	€ 64
France	€ 27	€ 46	€ 73	€ 117	€ 130	€ 49	€ 91	€ 83	€ 85	€ 81	€ 85	€ 57	€ 60
Germany	€ 26	€ 46	€ 81	€ 100	€ 112	€ 29	€ 83	€ 78	€ 86	€ 82	€ 86	€ 57	€ 37
Greece	€ 24	€ 43	€ 33	€ 85	€ 126	€ 101	€ 74	€ 66	€ 76	€ 72	€ 76	€ 50	€ 30
Hungary	€ 24	€ 43	€ 67	€ 49	€ 82	€ 44	€ 72	€ 63	€ 73	€ 70	€ 73	€ 49	€ 28
Ireland	€ 28	€ 48	€ 67	€ 78	€ 109	€ 66	€ 78	€ 97	€ 88	€ 84	€ 88	€ 62	€ 98
Italy	€ 26	€ 45	€ 56	€ 76	€ 88	€ 8	€ 78	€ 78	€ 83	€ 80	€ 83	€ 56	€ 46
Latvia	€ 25	€ 43	€ 63	€ 81	€ 105	€ 49	€ 74	€ 68	€ 74	€ 71	€ 74	€ 50	€ 41
Lithuania	€ 24	€ 43	€ 50	€ 78	€ 102	€ 47	€ 71	€ 61	€ 72	€ 68	€ 72	€ 48	€ 26
Luxembourg	€ 26	€ 45	€ 63	€ 94	€ 112	€ 40	€ 80	€ 74	€ 83	€ 80	€ 83	€ 56	€ 31
Malta	€ 24	€ 44	€ 58	€ 59	€ 108	€ 101	€ 75	€ 66	€ 76	€ 72	€ 76	€ 51	€ 29
Netherlands	€ 31	€ 51	€ 83	€ 101	€ 117	€ 42	€ 82	€ 120	€ 99	€ 95	€ 99	€ 71	€ 143

Total Unit Treatment Costs: Private Metric	Composting/Digestion				Incineration				MBT				Landfill
	Open Air Composting	In-Vessel Composting	Anaerobic Digestion	Electric Only	CHP	Heat Only	Combustion Only	Bio-stabilisation	Biodrying with no Plastics	Biodrying with Plastics Recycling	AD based MBT	Residual MRF + Combustion	
Poland	€ 26	€ 44	€ 67	€ 129	€ 153	€ 96	€ 115	€ 75	€ 77	€ 73	€ 77	€ 53	€ 59
Portugal	€ 24	€ 43	€ 54	€ 87	€ 127	€ 101	€ 75	€ 66	€ 75	€ 71	€ 75	€ 50	€ 33
Romania	€ 24	€ 43	€ 69	€ 90	€ 116	€ 64	€ 73	€ 63	€ 72	€ 69	€ 72	€ 48	€ 33
Slovakia	€ 26	€ 45	€ 47	€ 76	€ 101	€ 48	€ 72	€ 82	€ 79	€ 75	€ 79	€ 55	€ 78
Slovenia	€ 25	€ 44	€ 53	€ 93	€ 114	€ 50	€ 76	€ 72	€ 78	€ 74	€ 78	€ 53	€ 44
Spain	€ 25	€ 44	€ 66	€ 89	€ 131	€ 108	€ 82	€ 70	€ 79	€ 75	€ 79	€ 53	€ 34
Sweden	€ 28	€ 48	€ 85	€ 117	€ 128	€ 43	€ 96	€ 95	€ 90	€ 87	€ 90	€ 63	€ 85
United Kingdom	€ 29	€ 48	€ 65	€ 85	€ 114	€ 66	€ 78	€ 100	€ 89	€ 86	€ 89	€ 61	€ 107

3.1.5 Environmental Impacts Module

This section introduces the Environmental Impacts Module and, as far as possible, outlines some of the technical assumptions used in the modelling of the environmental impacts of the different waste management methods used by Member States. An overview of the Module is presented in Figure 3-7. From this it can be seen that the tonnage inputs are received from the Mass Flow Module (broken down by waste stream). The Environmental Impacts Module considers the environmental impacts associated with the following types of waste management:

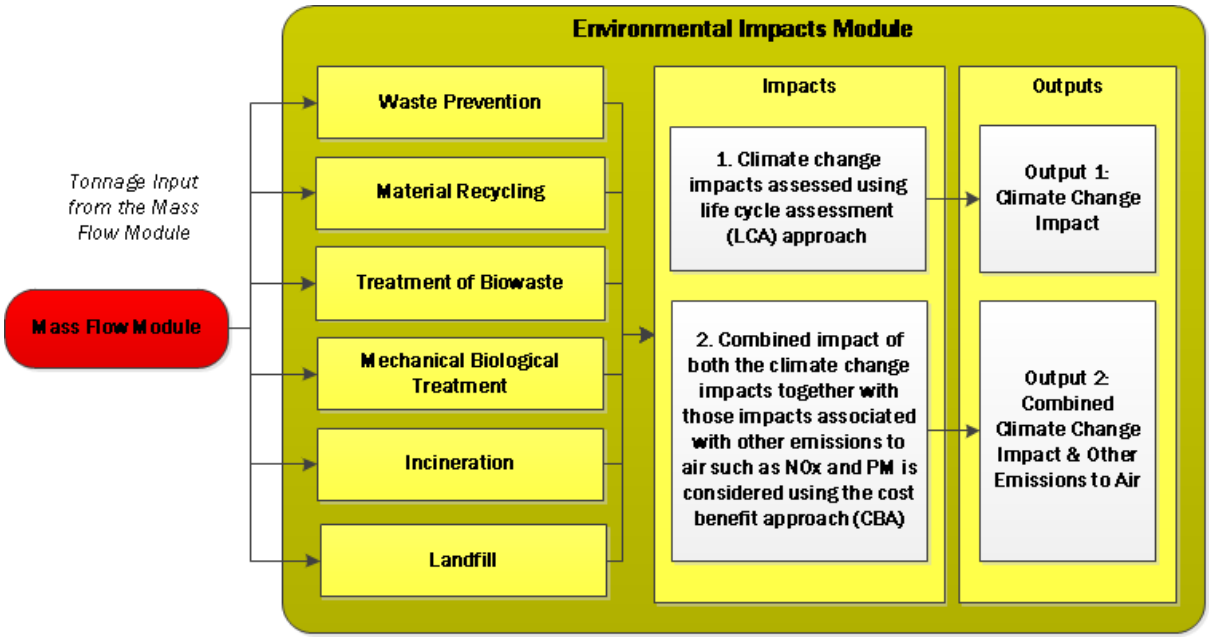
- Waste prevention;
- Recycling;
- The treatment of source segregated biowaste such as food and garden waste;[21]
- Mechanical Biological Treatment (and related) methods for managing residual waste;
- Incineration of residual waste; and
- Landfill of residual waste.

It can be seen from Figure 3-7 that the model uses two methods to assess the impacts of managing waste via each of the above routes:

- Climate change impacts are considered using the life cycle assessment (LCA) approach. Results in this case consider the impact in tonnes of CO_2 equivalent;
- The combined impact of both the climate change impacts together with those impacts associated with other emissions to air such as NOx and PM is considered using the cost benefit approach (CBA). Pollutant impacts are given a monetary value, such that the outcome can be considered in €. For the climate change impacts, the CBA model builds on the analysis undertaken for the LCA, as the two assessment methods use the same pollution inventory.

[21] The model separately considers both composting and anaerobic digestion processes.

Figure 3-7: Overview of the Environmental Impacts Module



3.1.5.1 Assessing the Impacts

In general, the modelling is based around a cost benefit framework. This type of approach seeks to understand the environmental consequences of different approaches to waste management in terms of the monetised impact of the changes being made. In principle, this allows for trade-offs to be made between the resource costs of any change, and the environmental benefits associated with them. The approach is rooted in 'life-cycle thinking', in that it considers not only direct emissions, but also, avoided emissions associated with the recycling of materials, or the generation of energy by waste management processes. It seeks, however, to express the impact of emitting pollutants, or avoiding their emission, in monetary terms.

There are some limitations regarding the extent to which this can be undertaken. For example:

- For all pollutants other than those (like greenhouse gases) which exert a global impact (i.e. an impact which is the same irrespective of the location of their emission), the impact is dependent upon the location of the emission. The location of the emission will determine the likely exposure of key receptors, whether they be human beings or other living organisms, or buildings (as with acidifying pollutants, for example). In such cases, the link between the emission and the impact is highly localised. Work in respect of understanding the link between the emission of a pollutant, and its impact, is furthest advanced where air pollutants are concerned. For some of these, ongoing work at the European level allows for some variation in the damage costs depending upon the country from which the emission originates, For others, a single value for the whole of Europe has been used;
- Whilst waste treatment processes may also lead to emissions to soil and water, research in respect of the quantification, at the margin, of the related impacts of

this is less well advanced. As such, it has not been possible to include these in the model. It is expected that the impacts of these would be highly location specific, depending on the nature and quality of the medium into which the pollutant was emitted;

- Where the emissions have a global impact, the issue of the location of the emission is less of an issue. However, where climate change emissions are concerned, there are a range of values suggested for the value of damages caused by marginal emissions of greenhouse gases into the environment. It should be noted that the value of ETS allowances in the market place does not reflect a measure of the damages caused by emissions of greenhouse gases (GHGs). Rather, it represents the cost, at the margin, of ensuring the overall level of emissions remains below the specified cap for the sectors covered by the EU-ETS;
- Waste management facilities also give rise to a loss in amenity, related to dust, noise, odour, and other forms of nuisance. These tend to be experienced by people and businesses in close proximity to a facility (or close to transport routes linked to a facility). There is a body of literature related to the assessment of disamenity at waste facilities, but it remains largely focused on landfill and incineration. Whilst the model allows for the inclusion of such values, the default approach is not to include them given the potential for bias associated with the absence of values for some facility types.
- Air Emissions other than the following are not included in the analysis: CO_2, CH_4, N_2O, NH_3, NOx, PM2.5 / PM10, SO_2, VOCs, Arsenic, Cadmium, Chromium, Nickel, 1,3 Butadiene, Benzene, PAH, Formaldehyde, and Dioxin. These air pollutants cover all of the pollutants which are routinely monitored at waste treatment plant, although plant will not typically measure the emission of all of those listed above (for example, most facilities do not regularly measure emission to air of formaldehyde). The list reflects those pollutants for which the environmental impacts are best understood and for which the most robust emissions measurement data is available. Although the analysis is based on emissions harmful to human health, there is a good overlap between the health impacts and ecological damage.
- The model does not consider the potential impact of bioaerosol pollution, as no exposure response relationship has yet been developed for this type of pollutant.
- No emissions to land have been included other than in respect of incinerator fly ash residues. This almost certainly means that the treatment of landfills is too favourable. In the case of the latter, impacts are more likely to occur over long timescales – potentially beyond the 100 year cut off point considered as the boundary of the analysis.
- The model considers the relative impact of compost application in comparison to the use of synthetic fertiliser, and as such the impact of compost utilisation on nitrate pollution is considered. Aside from this, the model does not consider the impact of water pollution as at present no damage cost data exists with which to consider the impact of water pollution.
- We have not considered external costs associated with construction of facilities. It is generally stated that these account for a small proportion of the overall impacts.

However, it is difficult to be quite so sanguine about this when a cost-benefit perspective, incorporating non-zero discount rates, is employed. All construction-related externalities occur early in time (by definition). Consequently, the construction related externalities will weigh proportionately greater in an analysis using discounting than in one where no discounting is used. Even where such an approach is used, however, the construction related impacts remain relatively insignificant in comparison the emissions to air. In addition, many of the materials with the greatest embedded environmental impacts (i.e., the metals) are likely to be recovered for recycling when the facility is decommissioned, reducing the overall burdens.

- The effect on household time has not been considered in this study.
- The consumption of water at facilities is also not considered within the model.

Further details the rationale for these omissions from the analysis can be found in the documentation that accompanies the European Reference Model on Municipal Waste Management. [22]

The set of data that we have used for the assessment of the externalities associated with emissions to air is based on modelling recently undertaken for the European Environment Agency (EEA).[23] Table 3-11 and Table 3-12 present the assumptions used in the model for the pollutants affecting air quality, reflecting the damage to human health. The EEA data also includes a monetary cost for the climate change impacts, which are attributed a cost of €33 per tonne of CO_2 equivalent emissions. The damage costs arising from the CO_2 impacts are based on the estimated marginal abatement cost based on the approach developed by the UK Government.

Our model uses the EEA value for the carbon damage cost out to 2029. After this point, we have based our assumption on the price projections given in the latest iteration of the EU-ETS and provided to us by DG Clima which suggest the cost of each EU Allowance unit (EUA) to be €35 in 2030 and €57 in 2035. For values after 2035 (used in the modelling of future landfill emissions) the model allows for impacts to be calculated using a fixed value of €57, or a declining impact based on the application of the EC's discount rate of 4%.

The model uses the following assumptions to calculate the global warming potential of the main greenhouse gases:[24]

- Methane is assumed to have a GWP of 25. This value is based on emissions of fossil methane. However, most methane emissions in the waste sector are biogenic methane emissions. A credit is applied to account for the differential in impact

[22] Eunomia Research & Consulting and Copenhagen Resource Institute (in development) *Development of a Modelling Tool on Waste Generation and Management*, Report for the European Commission DG Environment, www.wastemodel.eu

[23] The methodology used is summarised in: European Environment Agency (2011) Revealing the Costs of Air Pollution from Industrial Facilities in Europe, EEA Technical Report No 15/2011, November 2011

[24] IPCC (2007) Synthesis Report

between the fossil and biogenic methane impacts in landfill. As a consequence of the credit, the effective GWP for biogenic methane is 22.25; and

- N_2O is attributed a GWP of 298.

The above assumptions have been taken from the fourth assessment report of the IPCC. It is understood that the yet to be finalised fifth version of the assessment report will indicate an increase in the GWP for methane from 25 to 28 (if climate carbon feedbacks are excluded within the analysis) or 34 (including the impact of the climate carbon feedbacks). As the fifth report is currently scheduled for publication in January 2014, the project team consulted with DG Environment and DG Clima in respect of the inclusion of the revised assumptions for the GWP in the model. We have been advised to retain the assumptions from the fourth report, as the second phase of the Kyoto Protocol – currently being transposed into EU legislation – is based on the assumptions contained within this report. As such, we understand that European climate change policy will not be updated to reflect data from the fifth report until 2020 at the earliest.

3.1.5.2 System Boundaries

The environmental model covers the following aspects of the waste management system:

- The fuel use associated with waste collection (for residual waste, source segregated organic material and dry recyclables) as well as impacts associated with sorting recyclables;
- Benefits associated with dry recyclables (calculated by comparison with the impacts associated with producing material from virgin inputs);
- Impacts associated treating source segregated organic material; and
- Impacts associated with treating residual waste.

3.1.5.3 Dealing with Impacts over Time – the Discount Rate

There are two ways in which the issue of time has to be considered in the context of the existing model:

1. First, the model is designed to project waste management out to the year 2030. Impacts will, therefore, occur at different points in time depending upon the year in which waste is consigned to one or other management method; and
2. Second, some waste management processes – notably biological processes (landfill, composting, anaerobic digestion, MBT) – give rise to emissions which occur over an extended period of time after the waste was first received.

In order to account for the different time period in which impacts occur, the model applies a social discount rate of 4% (which is the value proposed for use in Impact Assessments undertaken by the European Commission).

For waste treatments which lead to emissions over an extended time horizon, such as landfill, then if the material is landfilled in Year X, the model assigns all the impacts associated with future emissions from the waste landfilled in Year X, discounted in the appropriate manner, to that year. We believe this gives the most realistic view to policy makers of the effect of changes in waste management in that it assigns the effect to the year in which a given change takes place.

Table 3-11: Damage Costs Applied to the Air Pollutants (2010 Prices) – Key Air Pollutants

Country	NH_3	NOx	PM2.5	PM10	SO_2	VOCs
Austria	€ 15,696	€ 12,383	€ 30,569	€ 19,850	€ 10,094	€ 812
Belgium	€ 27,980	€ 8,566	€ 44,388	€ 28,823	€ 11,392	€ 1,980
Bulgaria	€ 6,561	€ 5,929	€ 19,809	€ 12,863	€ 4,300	-€ 132
Cyprus	€ 17,569	€ 9,013	€ 27,591	€ 17,916	€ 7,390	€ 378
Czech Republic	€ 1,372	€ 665	€ 13,288	€ 8,629	€ 1,441	-€ 49
Denmark	€ 20,340	€ 8,887	€ 21,430	€ 13,915	€ 8,693	€ 498
Estonia	€ 8,011	€ 3,919	€ 11,231	€ 7,293	€ 4,835	€ 735
Finland	€ 6,982	€ 1,954	€ 7,328	€ 4,759	€ 4,353	€ 214
France	€ 4,639	€ 1,470	€ 7,333	€ 4,762	€ 3,024	€ 253
Germany	€ 10,877	€ 10,633	€ 31,239	€ 20,285	€ 9,893	€ 1,023
Greece	€ 21,117	€ 14,314	€ 45,861	€ 29,780	€ 12,650	€ 1,283
Hungary	€ 5,214	€ 1,694	€ 18,724	€ 12,158	€ 3,238	€ 62
Ireland	€ 17,195	€ 11,801	€ 30,195	€ 19,607	€ 8,389	€ 269
Italy	€ 2,420	€ 4,109	€ 15,656	€ 10,166	€ 5,960	€ 642
Latvia	€ 13,497	€ 8,629	€ 36,601	€ 23,767	€ 8,218	€ 643
Lithuania	€ 5,882	€ 3,106	€ 9,961	€ 6,468	€ 4,570	€ 381
Luxembourg	€ 5,923	€ 4,702	€ 9,978	€ 6,479	€ 5,118	€ 453
Malta	€ 23,898	€ 12,545	€ 33,080	€ 21,480	€ 10,241	€ 1,831
Netherlands	€ 8,077	€ 588	€ 16,271	€ 10,565	€ 2,926	€ 282
Poland	€ 20,319	€ 7,970	€ 40,980	€ 26,610	€ 13,180	€ 1,432
Portugal	€ 13,308	€ 6,803	€ 21,018	€ 13,648	€ 7,536	€ 581
Romania	€ 4,806	€ 1,389	€ 24,644	€ 16,002	€ 3,682	€ 331
Slovakia	€ 7,722	€ 9,256	€ 21,448	€ 13,927	€ 6,323	€ 162
Slovenia	€ 18,882	€ 10,482	€ 21,163	€ 13,743	€ 8,184	€ 294
Spain	€ 17,909	€ 10,308	€ 22,464	€ 14,587	€ 8,360	€ 517
Sweden	€ 5,445	€ 3,440	€ 19,934	€ 12,944	€ 5,463	€ 302
United Kingdom	€ 6,516	€ 2,370	€ 11,521	€ 7,481	€ 3,204	€ 381

Croatia	€ 15,583	€ 5,326	€ 25,322	€ 16,443	€ 8,033	€ 1,007

Table 3-12: Damage Costs Applied to the Air Pollutants (2010 Prices) – Heavy Metals

Country	Arsenic	Cadmium	Chromium	Nickel	1, 3 Butadiene	Benzene	PAH	Form-aldehyde	Dioxins/furans
Austria	€ 369,000	€ 29,000	€ 39,000	€ 4,000	€ 500	€ 80	€ 1,315,000	€ 220	€ 28,000,000
Belgium	€ 435,000	€ 50,000	€ 67,000	€ 6,700	€ 840	€ 120	€ 1,332,000	€ 360	€ 28,000,000
Bulgaria	€ 328,000	€ 17,000	€ 22,000	€ 2,200	€ 280	€ 50	€ 1,304,000	€ 120	€ 28,000,000
Cyprus	€ 340,000	€ 20,000	€ 27,000	€ 2,700	€ 340	€ 50	€ 1,307,000	€ 140	€ 28,000,000
Czech Republic	€ 371,000	€ 30,000	€ 40,000	€ 4,100	€ 500	€ 80	€ 1,315,000	€ 220	€ 28,000,000
Denmark	€ 323,000	€ 15,000	€ 20,000	€ 2,000	€ 250	€ 40	€ 1,301,000	€ 110	€ 28,000,000
Estonia	€ 301,000	€ 8,300	€ 11,000	€ 1,100	€ 140	€ 30	€ 1,296,000	€ 60	€ 28,000,000
Finland	€ 304,000	€ 9,100	€ 12,000	€ 1,200	€ 150	€ 30	€ 1,296,000	€ 60	€ 28,000,000
France	€ 390,000	€ 33,000	€ 49,000	€ 4,800	€ 610	€ 90	€ 1,320,000	€ 270	€ 28,000,000
Germany	€ 420,000	€ 45,000	€ 61,000	€ 6,100	€ 760	€ 110	€ 1,328,000	€ 330	€ 28,000,000
Greece	€ 330,000	€ 17,000	€ 23,000	€ 2,400	€ 290	€ 50	€ 1,304,000	€ 120	€ 28,000,000
Hungary	€ 368,000	€ 29,000	€ 39,000	€ 3,800	€ 480	€ 70	€ 1,314,000	€ 210	€ 28,000,000
Ireland	€ 324,000	€ 15,000	€ 20,000	€ 2,000	€ 260	€ 40	€ 1,302,000	€ 110	€ 28,000,000
Italy	€ 380,000	€ 33,000	€ 44,000	€ 4,400	€ 540	€ 80	€ 1,317,000	€ 240	€ 28,000,000
Latvia	€ 307,000	€ 10,000	€ 13,000	€ 1,300	€ 160	€ 30	€ 1,297,000	€ 70	€ 28,000,000
Lithuania	€ 316,000	€ 13,000	€ 17,000	€ 1,700	€ 220	€ 40	€ 1,300,000	€ 90	€ 28,000,000
Luxembourg	€ 377,000	€ 32,000	€ 43,000	€ 4,300	€ 530	€ 80	€ 1,317,000	€ 240	€ 28,000,000
Malta	€ 312,000	€ 12,000	€ 15,000	€ 1,500	€ 200	€ 30	€ 1,298,000	€ 80	€ 28,000,000
Netherlands	€ 446,000	€ 53,000	€ 71,000	€ 7,200	€ 890	€ 130	€ 1,334,000	€ 390	€ 28,000,000
Poland	€ 358,000	€ 26,000	€ 35,000	€ 3,500	€ 430	€ 70	€ 1,312,000	€ 190	€ 28,000,000
Portugal	€ 331,000	€ 18,000	€ 24,000	€ 2,400	€ 300	€ 50	€ 1,305,000	€ 120	€ 28,000,000
Romania	€ 339,000	€ 20,000	€ 27,000	€ 2,700	€ 330	€ 50	€ 1,306,000	€ 140	€ 28,000,000
Slovakia	€ 366,000	€ 28,000	€ 38,000	€ 3,700	€ 470	€ 70	€ 1,313,000	€ 210	€ 28,000,000
Slovenia	€ 371,000	€ 30,000	€ 40,000	€ 4,100	€ 500	€ 80	€ 1,315,000	€ 220	€ 28,000,000

Spain	€ 329,000	€ 17,000	€ 23,000	€ 2,200	€ 280	€ 50	€ 1,304,000	€ 120	€ 28,000,000
Sweden	€ 318,000	€ 13,000	€ 18,000	€ 1,800	€ 230	€ 40	€ 1,300,000	€ 90	€ 28,000,000
United Kingdom	€ 376,000	€ 32,000	€ 42,000	€ 4,300	€ 530	€ 80	€ 1,316,000	€ 230	€ 28,000,000
Croatia	€ 349,000	€ 23,000	€ 31,000	€ 3,100	€ 390	€ 60	€ 1,309,000	€ 160	€ 28,000,000

3.1.5.4 Energy Generation

Given that the scenarios appraised in this study reflect changes to current waste management, the use of the marginal energy source appears to be the right approach to take within the current analysis. However, determining which is the marginal source across each Member State is not straightforward. A detailed discussion of this subject is provided in the documentation which accompanies the model. [25]

As part of the consultation process undertaken as part of the project Member States were asked to supply specific data on the marginal electricity and heat generation source including projections of this data going out to 2030. Respondents were also asked to provide information on the generation mix for both types of energy. Responses were received from some member states in respect of the marginal source of electricity generation, although the majority were not able to provide any information in respect of the marginal heat source, and few provided information in respect of future variations in the mix. The approach taken in the model is as follows:

- Where countries have supplied us with assumptions on the marginal sources, this data is incorporated into the model;
- Where only the grid mix data was supplied by MS, this was used in the model;
- Where no information on energy generation was supplied by the Member State we have used data on the electricity and heat generation mix from the IEA and European Commission (see tables below).

Table 3-13 presents the assumptions used for electricity impacts for each Member State in 2011 and Table 3-14 presents the heat mix for each Member State in 2011. The emission factors (i.e. air pollutants) associated with the generation of heat and electricity from each of the sources identified in these tables are presented are summarised within the documentation accompanying the model.

Table 3-13: Electricity Generation Mix – EU Member States

Member State	Coal	Gas	Nuclear	Renewables[1]	Other[2]
Austria	7.29%	17.88%	0.00%	72.00%	2.83%
Belgium	6.74%	32.13%	51.76%	7.02%	2.35%
Bulgaria	48.71%	5.17%	31.47%	13.79%	0.86%
Croatia	25.99%	0.00%	0.00%	48.01%	25.99%
Cyprus[3]	0.00%	0.00%	0.00%	0.00%	100.00%
Czech Rep.	59.20%	1.19%	33.08%	6.32%	0.21%
Denmark[4]	91%	5%	0%	24.84%	4%
Estonia[3]	0%	2%	0%	9%	89%
Finland[4]	100%	0%	0%	0%	07%

[25] Eunomia Research & Consulting and Copenhagen Resource Institute (in development) *Development of a Modelling Tool on Waste Generation and Management*, Report for the European Commission DG Environment, www.wastemodel.eu

Member State	Coal	Gas	Nuclear	Renewables[1]	Other[2]
France[3]	5%	4%	78%	10%	2%
Germany	43.40%	13.31%	22.77%	16.18%	4.33%
Greece	55.71%	17.96%	0.00%	13.78%	12.54%
Hungary[3]	18%	30%	44%	2%	5%
Ireland[3]	28%	62%	0%	8%	3%
Italy	14.84%	50.32%	0.00%	24.61%	10.23%
Latvia[4]	0.00%	100%	0.00%	0%	0.00%
Lithuania	0.00%	60.38%	0.00%	28.30%	11.32%
Luxembourg	0.00%	73.31%	0.00%	24.99%	1.70%
Malta[4]	0.00%	0.00%	0.00%	2%	98%
Netherlands	23.44%	60.53%	3.73%	8.16%	4.14%
Poland[4]	100%	0%	0%	0%	0%
Portugal[4]	0%	100%	0%	0%	0%
Romania	34.16%	12.05%	19.14%	33.50%	1.16%
Slovak Rep.	16.35%	7.53%	53.84%	19.59%	2.69%
Slovenia[4]	100%	0%	0%	0%	0%
Spain[3]	9%	32%	21%	31%	8%
Sweden[4]	0%	100%	0%	0%	0%
UK[4]	0%	100%	0%	0%	0%

Notes:

1. *Includes biofuels and biomass*
2. *Includes oil and waste*
3. *Fuel mix data supplied by Member State*
4. *Marginal source data supplied by Member State*

Sources: IEA Statistics (available from www.iea.org/stats/); European Commission Country Factsheets (available from http://ec.europa.eu/energy/observatory/countries/doc/2012-country-factsheets.pdf)

Table 3-14: Heat Generation Mix – EU Member States

Member State	Coal	Gas	Oil	Biomass	Other
Austria	5%	44%	10%	33%	9%
Belgium	0%	86%	0%	2%	12%
Bulgaria	37%	49%	9%	0%	6%
Croatia	0%	0%	0%	0%	0%
Cyprus	0%	0%	0%	0%	0%
Czech Rep.	68%	23%	2%	2%	4%
Denmark	26%	28%	5%	20%	21%
Estonia[1]	0%	42%	26%	31%	0%
Finland	35%	25%	8%	27%	5%
France	10%	61%	16%	0%	13%
Germany	32%	49%	2%	3%	14%
Greece	99%	0%	1%	0%	0%
Hungary	13%	76%	6%	2%	3%
Ireland	0%	0%	0%	0%	0%
Italy	1%	60%	35%	3%	3%
Latvia[1]	1%	81%	2%	16%	0%
Lithuania[1]	0%	73%	3%	23%	1%

Member State	Coal	Gas	Oil	Biomass	Other
Luxembourg	0%	0%	0%	100%	0%
Malta[1]	0%	0%	95%	2%	3%
Netherlands	11%	77%	4%	1%	7%
Poland[1]	0%	31%	18%	51%	0%
Portugal	0%	70%	30%	0%	0%
Romania	25%	64%	9%	2%	0%
Slovak Rep.	23%	53%	12%	6%	7%
Slovenia[1]	57%	31%	2%	10%	0%
Spain	0%	0%	0%	0%	0%
Sweden[2]	0%	0%	0%	100%	0%
UK[2]	0%	100%	0%	0%	0%

Notes

1. *Fuel mix data supplied by Member State*
2. *Marginal source data supplied by Member State*

Sources: IEA Statistics (available from www.iea.org/stats/); European Commission Country Factsheets (available from http://ec.europa.eu/energy/observatory/countries/doc/2012-country-factsheets.pdf)

Table 3-15 confirms the emissions factors used to estimate the impacts of electricity generation for the different generation sources considered within the current analysis, whilst Table 3-16 confirms the emissions factors used to estimate the impacts of heat generation.

Table 3-17 presents the emissions factors used for diesel combustion. The source of the emissions data is the ecoinvent database, which includes for the majority of fuels a dataset considered to be representative of European facilities.

Table 3-15: Emissions Factors for Electricity Generation (tonnes pollutant / kWh)

	CO2e	NH3	NOx	PM	SO2	VOCs
Gas	0.4	1.4034E-10	2.5304E-07	1.275E-09	1.6263E-09	1.5578E-09
Coal	0.8	2.6636E-10	7.1098E-07	2.428E-09	4.1141E-08	1.6624E-08
Nuclear	0.001	1.4504E-10	3.8024E-09	6.398E-10	1.6195E-08	1.8067E-10
Renewables	0.001	3.675E-11	8.6228E-09	1.619E-09	1.3942E-08	2.3682E-09

Source: ecoinvent

	Arsenic	Cadmium	Chromium	Nickel	1, 3 Butadiene	Benzene	PAH	Formaldehyde	Dioxins/furans
Gas	2.76E-15	2.3269E-15	1.2903E-16	2.2382E-12	2.0709E-19	1.7024E-12	2.4785E-13	1.9003E-12	6.3519E-19
Coal	6.735E-12	1.7428E-12	1.3353E-13	1.4377E-11	6.5556E-19	1.0881E-14	6.5846E-13	2.996E-11	1.5426E-18
Nuclear	2.006E-13	3.1833E-13	8.9085E-15	6.4668E-12	1.3962E-18	1.6996E-11	2.5287E-13	1.0827E-11	4.2164E-19
Renewables	3.126E-13	8.2309E-14	3.0718E-14	2.623E-12	6.548E-19	2.8188E-11	2.1087E-13	5.3271E-12	3.6474E-18

Source: ecoinvent

Table 3-16: Emissions Factors for Heat Generation (tonnes pollutant / kWh)

	CO2e	NH3	NOx	PM	SO2	VOCs
Gas	0.2	2.97E-11	1.37E-07	1.18E-09	9.53E-09	1.09E-09
Coal	0.3	1.52E-10	9.13E-07	1.82E-07	2.27E-06	8.03E-09
Oil	0.25	6.47E-11	1.23E-07	5.97E-09	2.35E-07	2.22E-09
Solid biomass	0.001	8.31E-09	7.31E-07	5.61E-07	1.73E-08	5.19E-08

Source: ecoinvent

	Arsenic	Cadmium	Chromium	Nickel	1, 3 Butadiene	Benzene	PAH	Formaldehyde	Dioxins/furans
Gas	1.47E-13	9.46E-14	6.94E-15	4.75E-12	6.74E-18	1.46E-09	3.65E-11	3.72E-10	1.36E-18
Coal	1.14E-10	7.35E-12	1.02E-10	9.36E-11	1.21E-17	2.28E-09	5.38E-13	3.79E-10	9.08E-17
Oil	1.31E-12	2.95E-12	1.95E-14	3.59E-11	2.13E-18	6.37E-10	1.95E-12	3.59E-11	9.77E-19
Solid biomass	4.91E-12	3.47E-12	2.00E-13	3.06E-11	1.41E-17	4.38E-09	5.33E-11	6.27E-10	1.59E-16

Source: ecoinvent

Table 3-17: Emissions Factors for Diesel Combustion (tonne / litre)

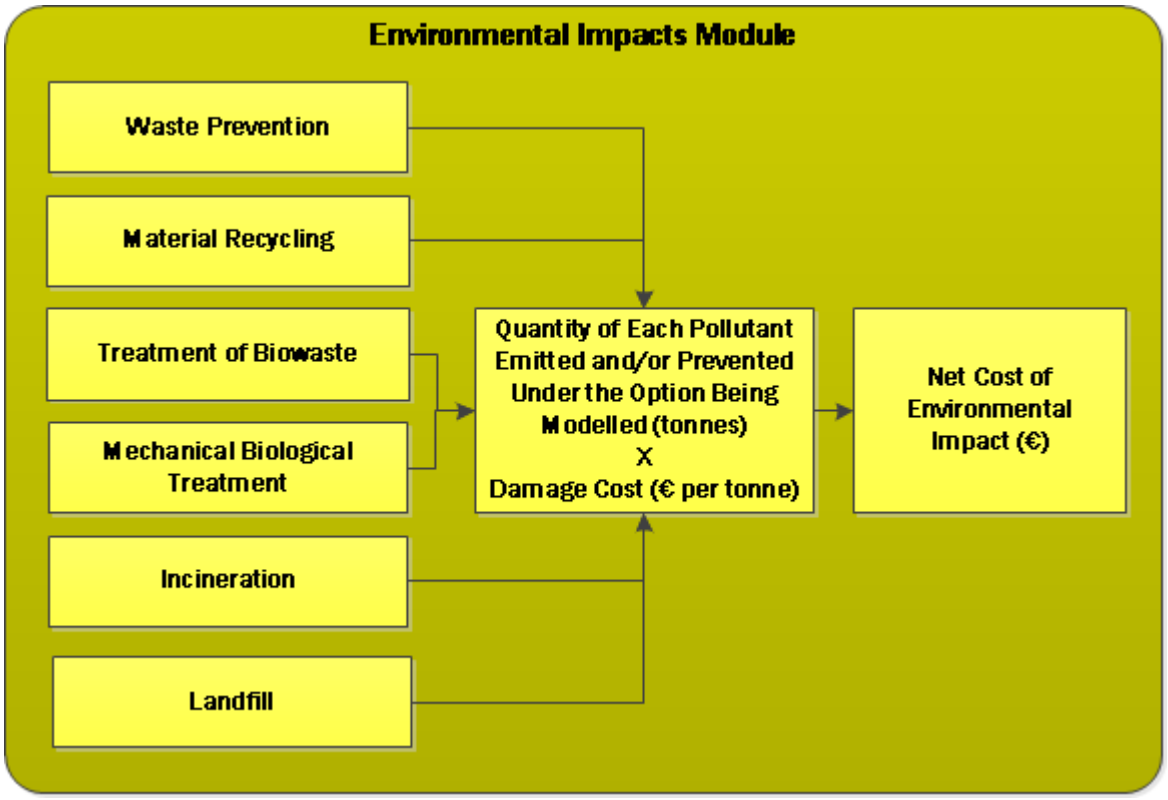
	CO2e	NH3	NOx	PM	SO2	VOCs	Arsenic	Cadmium
Diesel	0.0026	6.83E-10	1.30E-06	5.78E-08	2.48E-06	2.34E-08	1.39E-11	3.12E-11
	Chromium	Nickel	1, 3 Butadiene	Benzene	PAH	Formaldehyde	Dioxins/furans	
Diesel	2.06E-13	3.79E-10	2.25E-17	6.73E-09	2.05E-11	3.79E-10	1.03E-17	

Source: ecoinvent

3.1.5.5 Impacts of Differente Waste Mangement Options

Section 3.1.5.1 outlines the damage costs that were used to monetise the impact of climate change and air pollution resulting from a number of common pollutants. Simply put, the model uses these damage costs and multiplies them by the quantity of each air pollutant that is created or avoided by the option that is being modelled. This process is summarised in Figure 3-8.

Figure 3-8: Calculating the Damage Costs Resulting from Emissions to Air



The model includes default assumptions for the amount of air emissions that arise or are avoided from each of the waste management options shown in Figure 3-8. These are very briefly introduced below.

Waste Prevention

Table 3-18 presents the data on avoided manufacturing burdens for key waste materials. The table shows the data on avoided greenhouse gas burdens and that associated with the

main air quality impacts.[26] Biogenic CO_2 emissions are also separately presented where data is available.

[26] In addition to the impacts shown in the table, there will also be some avoided heavy metal burdens not shown in the table, but these typically have a relatively minor impact in comparison to those shown in the table

Table 3-18: Avoided Manufacturing Burdens

Material	Global Warming Potential, tonne CO_2 eq. per tonne material (excl. biogenic CO_2)	Biogenic CO_2 (tonne CO_2 eq. per tonne material)	Air Quality Impacts (tonne pollutant per tonne of material)					
			NH_3	NOx	$PM_{2.5}$	PM_{10}	SO_2	VOCs
Paper	0.96	3.01E-03	2.00E-05	0.00379	3.42E-05	6.90E-05	3.90E-03	7.54E-05
Card	1.32	3.25E-03	1.63E-05	0.00351	4.71E-05	1.20E-05	4.08E-03	9.46E-05
Plastics	1.95	1.08E-06	3.13E-06	3.23E-03	8.25E-05	3.17E-05	4.10E-03	9.38E-05
Glass	0.88	1.19E-03	2.09E-06	0.00316	5.72E-05	5.37E-05	0.0039	0.00022472
Ferrous metal	1.79	1.76E-03	8.67E-06	0.003803	0.001461	0.003126	0.004	0.00026858
Non-ferrous metal	11.46	2.52E-02	5.84E-05	0.0171	0.002025	0.006594	0.0349	0.0020501
Food waste	3.80	No data	5.32E-04	3.49E-03	3.70E-05	7.70E-05	1.46E-03	3.87E-05
Textiles	26.12	4.62E-02	0.017222	0.077	0.001379	0.000809	0.153	0.0016132
Wood	0.41	0.56	6.00E-05	1.80E-03	4.00E-04	6.00E-05	7.40E-04	0.0012
WEEE	5.28	0.01	1.7572E- 5	0.0138	0.001261	0.001258	0.0238	0.000806

Sources: ecoinvent and Sima Pro life cycle databases; Stoessel F, Juraske R, Pfister S and Hellweg S (2011) Life Cycle Inventory and Carbon and Water Footprint of Fruits and Vegetables: Application to a Swiss Retailer, Environmental Science & Technology, 46, pp3253-3262

Recycling

A summary of assumptions with regard to the climate change impacts of recycling different materials is presented in Table 3-19 which also contains the sources of the information used.[27] The climate change impacts associated with recycling are global impacts – as such, there is no difference in the impact of one tonne of CO_2 emitted within Europe's geographical boundaries to the same quantity emitted outside Europe.

Table 3-19: Impacts of Dry Recycling – Values Used in the Model

	GWP	Biogenic CO_2	Source
Card	-0.001	-1.421	ecoinvent
Newsprint	-0.231	-0.258	ecoinvent
Bottle plastics	-1.182	0.042	APME (via WRATE)
Mixed dense plastics	-1.075	0.056	APME (via WRATE)
Textiles	-4.459	-0.604	WRATE
Wood	-0.062	0.000	Prognos
Glass - aggregate	-0.025	-0.001	WRATE
Glass - containers	-0.229	0.001	British Glass
Ferrous metal	-1.631	-0.003	ecoinvent
Non-ferrous metal	-9.17	-	EEA
WEEE	-1.482	-	UN University

Sources: ecoinvent; WRATE; Huisman, J., et al (2008) 2008 Review of Directive 2002/96 on Waste Electrical and Electronic Equipment – Study No. 07010401/2006/442493/ETU/G4, United Nations University, Bonn Germany, cited in Zero Waste Scotland (2011) The Scottish Carbon Metric, report for Scottish Government, March 2011; Prognos / IFEU / INFU (2008) Resource Savings and CO_2 Reduction Potential in Waste Management in Europe and the Possible Contribution to the CO_2 Reduction Targets in 2020, October 2008

The air quality impacts of recycling are considered under the CBA approach. Whereas a number of authors have considered the climate change benefits of recycling, much less data is publicly available regarding the air quality impacts of recycling.

[27] A literature review outlining the rationale for using these figures has been produced as part of the modelling project.

Where damage cost data is used within the assessment, air quality impacts vary geographically across European Member States. This makes it possible to estimate impacts where the emissions are known to occur in EU countries. However, both the recycling of the material, and the location of the 'avoided primary production' might well be outside the EU. There is a long history of exports of fibres to Asia, whilst the export of plastics for recycling has also become increasingly significant. For scenario analysis, therefore, it would ideally be known where any additional material was going to be recycled, in what location primary production was being avoided, and what the relevant set of damage costs would be in those countries. In practice, these questions are difficult to answer, not least because no damage cost data exists for countries outside of Europe. These issues add a further layer of complexity to the consideration of the air quality impacts associated with dry recycling, where some of both the primary and secondary manufacture of certain materials is likely to take place outside Europe, and where material flows across Member States are also likely to occur.

High level data on European production and the extra-European imports and exports of the materials commonly recycled is available through several databases as well as via publications of the European trades associations and other publications of the European Commission.[28] The project team also surveyed Member States for information on the proportion of collected recyclate exported outside of Europe for re-processing, and received relevant information in this respect from a number of countries. This data is summarised in Table 3-20. The data is used to inform the decision for the inclusion or exclusion of the air quality benefits associated with recycling.

Where the available data suggests a significant proportion of both the primary and secondary manufacture takes place within Europe, the air quality benefits of recycling are included within the analysis. This is assumed to be the case for paper/card, plastics, glass and wood. Although a significant proportion of metal reprocessing takes place within Europe, a significant proportion of the primary manufacture takes place outside it. The latter is also true for a significant proportion of primary textiles manufacture, and in this case a significant proportion of material collected through "recycling" collections is actually sold for resale in countries outside of the EU. Air quality benefits associated with recycling are therefore excluded for these materials, as the impacts are felt to be too uncertain to be quantified using damage cost data.

[28] Relevant information can be found in Comext and Market Access Databases (see http://epp.eurostat.ec.europa.eu/newxtweb/ and http://madb.europa.eu/madb/indexPubli.htm). Other sources: Ecorys / Danish Technical Institute / Cambridge Econometrics / CES ifo / Idea Consult (2008) Study on the Competitiveness of the European Steel Sector: Within the Framework of Sectoral Competitiveness Studies ENTR/06/054, Final Report for DG Enterprise and Industry, August 2008; Plastics Europe (2010) Plastics – the Facts 2010: An Analysis of European Plastics Production, Demand and Recovery for 2009; CEPI (2013) Key Statistics: European Pulp and Paper Industry 2012

Given this methodology, the principal air quality impacts used in the model are outlined in Table 3-21 which provides this information in terms of the tonnes of pollutant per tonne of recyclate.

Table 3-20: Treatment of Air Quality (AQ) Benefits from Recycling in the Cost-Benefit Analysis (CBA)

	Location of primary manufacture	Reprocessing of recyclate	Treatment of AQ benefits in the CBA
Paper / card	A significant proportion currently takes place within the EU	Some is exported but the majority is remanufactured within the EU	AQ benefits of recyclate included
Plastic	A significant proportion currently takes place within the EU	Some is exported but the majority is remanufactured within the EU	AQ benefits of recyclate included
Textiles	A significant proportion currently takes place outside of the EU	Recycled textiles largely treated within the EU but textiles suitable for reuse may be exported outside it	AQ benefits of recyclate excluded
Wood	A significant proportion takes place within the EU	Much is reused within the EU although relatively little is recycled	AQ benefits of recyclate included
Glass	Most takes place within the EU	Not typically exported outside the EU	AQ benefits of recyclate included
Ferrous metal	A significant proportion of primary steel production takes place outside of the EU	A significant proportion of steel reprocessing takes place within the EU	AQ benefits of recyclate excluded
Non-ferrous metal	A significant proportion of primary aluminium production takes place outside of the EU	A significant proportion of aluminium reprocessing takes place within the EU	AQ benefits of recyclate excluded

Sources: Comext database (see http://epp.eurostat.ec.europa.eu/newxtweb/) and Market Access Databases (see http://madb.europa.eu/madb/indexPubli.htm); Ecorys / Danish Technical Institute / Cambridge Econometrics / CES ifo / Idea Consult (2008) Study on the Competitiveness of the European Steel Sector: Within the Framework of Sectoral Competitiveness Studies ENTR/06/054, Final Report for DG Enterprise and Industry, August 2008; Plastics Europe (2010) Plastics – the Facts 2010: An Analysis of European Plastics Production, Demand and Recovery for 2009; CEPI (2013) Key Statistics: European Pulp and Paper Industry 2012

Table 3-21: Principal Air Quality Impacts of Dry Recycling– Values Used in the Model

	Tonnes of pollutant per tonne of recyclate					
	NH_3	**NOx**	**PM2.5**	**PM10**	**SO_2**	**VOCs**
Card	0.0000505	-0.00122	-0.000385	-0.00000646	-0.0000065	-0.000161
Newsprint	-0.00000333	-0.00122	-0.000128	-0.0000073	-0.00000735	-0.0000443
HDPE (bottles)	0.00000914	-0.00227	-0.000108	0.000000565	0.00000488	-0.00351
PP PS (mixed dense plastic)	0.00000577	-0.00221	-0.0000984	-0.00000414	0.00000318	-0.00302
Wood	-2.26E-07	-5.89E-06	-0.00000475	0.0000057	0.0000034	-0.0000751
Glass aggregate	-0.00000107	-0.000122	-0.00000412	-7.47E-07	-0.00000265	-0.0000266
Glass container	-0.00015	-0.000588	-0.0000429	-0.00000573	-0.0000277	-0.0000533

Notes:

Recycling processes also result in minor benefits in respect of heavy metal emissions, which are not shown in the table.

Air quality impacts for metals and textiles are not included in the model.

3.1.5.6 Biowaste Treatment

Composting

The following assumptions have been made with regard to air emissions from open-air windrow and in vessel composting facilities.

Greenhouse Gases

Our assumptions for biogenic CO_2 generation assume the production of a relatively mature compost, such that more of the gas is emitted during the composting phase than would be the case with a less mature product.

There is some debate as to whether methane is emitted in any significant quantities at well managed compost sites. Some have suggested that where process is managed correctly, methane emissions will be negligible as those that occur in the middle of the composting mass will be oxidised at the surface of the composting piles.[29]

For enclosed facilities we assume emissions of 700 g of CH_4 per tonne of waste to facility, whilst the figure for open (windrow) processes is taken to be 50 g of CH_4 per tonne. These values reflect the lowest values seen in Amlinger et al (2008) and are taken to be indicative of well managed composting processes.[30]

N_2O emissions from composting plant are closely linked to ammonia emissions and are therefore discussed below.

Nitrogenous Emissions

There are two principle sources of nitrous oxide emissions in composting processes:

- Direct emissions of the gas to air from the composting process itself; and
- Additional emissions resulting from the use of biofilters in enclosed processes to reduce emissions of ammonia.

For enclosed (in vessel) facilities, we assume the use of a biofilter. This has the effect of converting some of the ammonia to N_2O, such that emissions of the latter are higher for enclosed facilities. Ammonia emissions are therefore higher at open air facilities, where no such abatement equipment can be used. Data in this respect is presented in Table 3-22. Ammonia emissions are somewhat higher for food waste as the material typically contains more nitrogen than is the case with garden waste.

Table 3-22: Nitrogenous Emissions to Air from Composting Facilities

	Open air composting facilities (g gas per tonne of waste treated)	Enclosed (in vessel) composting facilities (g gas per tonne of waste treated)

[29] Dimitris P. Komilis and Robert K. Ham (2004) Life-Cycle Inventory of Municipal Solid Waste and Yard Waste Windrow Composting in the United States, Journal of Environmental Engineering, Vol. 130, No. 11, November 1, 2004, p.1394

[30] Amlinger F, Peyr S and Cuhls C (2008) Greenhouse Gas Emissions from Composting and Mechanical Biological Treatment, Waste Management and Research, 26, pp47-60

N_2O	100	150
Ammonia – food waste	540	27
Ammonia – garden waste	339	17

Emissions of ammonia can be further reduced through the use of a scrubber prior to the biofilter. This is not included within the model as the technology is not employed as standard throughout Europe. The approach taken in the model will therefore overestimate pollution impacts from enclosed facilities in countries such as Germany and Austria where the use of this type of abatement equipment is more prevalent. The use of such equipment can result in a reduction in ammonia emissions of 80%.

VOCs

Relatively few studies make reference to emissions of VOCs. In the UK, however, the Environment Agency did measure emissions from sites suggesting VOC emissions in the order of 25 g per tonne of waste treated at the facility.[31] This figure is reduced for in-vessel facilities where it is assumed the use of biofilters reduces the emissions by 80%. The use of biofilters is assumed to result in zero damage cost for the remaining 20% of VOC emission (i.e. the biofilter is assumed to remove those pollutants that result in the health effects).

In addition to the above impacts the model also takes into account the benefits of using compost on agricultural land as this helps to offset the use of chemical fertilisers. Further details on this and the assumed energy use at composting facilities can be found in the documentation which accompanies the model.

Anaerobic Digestion

As is the case with composting processes, direct emissions to air from AD systems result both from the treatment process itself as well as from the use of the digestate. In addition to biogenic CO_2 emissions, some fugitive methane emissions occur. Further emissions impacts arise from the combustion of the biogas during its utilisation for energy generation; as such emissions impacts are typically higher than is the case for composting processes, although the energy generation also results in avoided emissions impacts which are discussed below. Assumptions are presented in Table 3-23.

Table 3-23: Emissions from the AD process

	Emissions impacts, tonnes pollutant per tonne of waste treated
Biogenic CO_2	
Food waste	0.45
Garden waste	0.27
CH_4	
Food waste	0.002
Garden waste	0.001

[31] Environment Agency (2000) Life Cycle Inventory Development for Waste Management Operations: Composting and Anaerobic Digestion, R&D Project Record P1/392/4

	Emissions impacts, tonnes pollutant per tonne of waste treated
NH_3	1.25E-05
NOx	0.00025
PM	0.00002
SO_2	0.00002
VOCs	0.00004

In addition to the process emissions, additional climate change impacts result from the use of digestate:

- Assumed to be 0.05 tonnes CO_2 equivalent per tonne of feedstock where food waste is the feedstock;
- Assumed to be 0.98 tonnes CO_2 equivalent per tonne of feedstock where garden waste is the feedstock.

Energy requirements for the AD process are typically met through energy generated at the plant. Benefits from energy generation included within the model account for the use of energy through the AD process, taking into account the electricity and heat used by the AD process.

Assumptions regarding the net energy generation for each option are outlined in Table 3-24, which presents values for food and garden waste. The data confirms that energy generation from garden waste is much lower than that of food waste, as garden waste is more resistant to the anaerobic degradation process. Avoided emissions from the energy generation are calculated based on the data presented in Section 3.1.5.4.

Table 3-24: Energy Generation from AD Facilities

	Biogas combustion in a gas engine		Upgraded biogas (bio-methane)	
	Electricity (kWh / tonne of waste)	Heat (kWh / tonne of waste)	Gas grid[1] (kWh / tonne of waste)	Vehicle fuel[2] (litres vehicle fuel / tonne waste)
Food	376	182	915	80
Garden	161	78	395	38

Notes

1. *Bio-methane utilised in this way is assumed to offset an equivalent amount of natural gas.*
2. *Bio-methane utilised in this way is assumed to offset an equivalent amount of diesel combusted in a heavy goods vehicle*

3.1.5.7 Landfill

Data on the generation of landfill gas from the degradation of the organic waste streams was obtained from the ETC/EEA landfill model.[32] This allowed for the development of country-specific emissions factors for landfilled wastes. The ETC/EEA landfill model was developed on the basis of the 2006 IPCC guidelines.[33] Methane emissions were calculated on the basis of a first order decay model, provided by the IPCC and used by countries for the National Inventory Reporting (NIR).[34]

Some of the main environmental assumptions associated with lanfilling are presented below.

Gas Capture Assumptions under the Life Cycle and Cost Benefit Approaches

The model assumes that 50% of the landfill gas is captured from all sites in all Member States.

Gas Capture Assumptions under the Inventory Approach

The ETC/EEA model assumes a maximum feasible recovery rate for landfill gas of 50%. This percentage is considered a maximum technically achievable recovery rate, and it has been used as the maximum, regardless of the values reported in the NIR and CRF.[35] For countries with a recovery rate smaller than 50%, the model uses the countries' reported recovery figures. Estimates of gas collection are based on 2007 data which was reported in 2009.

Oxidation of Landfill Gas

Some of the uncaptured landfill gas will be oxidised as it passes through the cap to the surface, the proportion being dependent upon the nature of the cap. The model assumes that this is 10%, based on information from the IPCC and US EPA; however, it is acknowledge that in many cases this may overestimate fugitive emissions of methane occurring from landfill.

Direct Emissions to Air

Direct emissions to air will relate to gas generation assumptions and landfill gas management. Impacts from landfilled waste occur over a considerable time period. The approach used to consider the effect of this time delay is outlined for each assessment method.

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[32] ETC/EEA (2009). Waste model developed internally by the European Topic Centre for the EEA for internal use. Supporting Documentation for the model: ETC/SCP (2011). Projections of Municipal Waste Management and Greenhouse Gases. Prepared by Bakas et al., 89 pp. Copenhagen, Denmark.

[33] IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 5 Waste.

[34] Excel model available from IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 5 Waste.

[35] Some countries in their reporting claim that higher methane extraction rates are attainable; however given the uncertainties associated with modelling these impacts a more conservative approach has been taken

Life Cycle Approach

Thee life cycle approach used in the model considers only the climate change impacts through calculating the GWP of each treatment method.

Landfill impacts are calculated over a 100 year period, with the total impact over this period being attributed to the year in which the waste is deposited. Impacts are only considered for the biogenic materials (food and garden waste, paper, textiles, wood, miscellaneous combustibles and fines). At the end of the 100 year period, some of the biogenic carbon remains un-emitted. The GWP results for landfill are therefore adjusted with a credit for the un-emitted biogenic carbon, which is intended to account for the exclusion of the biogenic CO_2 impacts from the GWP calculation.

The size of the credit will depend on the assumptions contained within the MS landfill models in respect of the behaviour of the degradable organic carbon, and will also vary between different types of organic waste. For example:

- Where food waste is landfilled in Austria, 50% of the biogenic carbon is assumed to be stored at the end of the period of analysis, leading to a temporary storage credit of 366 CO_2 eq. per tonne of food waste (food waste is assumed to contain 200 kg of biogenic carbon);
- Where paper is landfilled in Spain, 192 kg of carbon is assumed to be stored out of a total of 300 kg of biogenic carbon, leading to a temporary storage credit of 704 kg CO_2 equivalent per tonne of paper.

Some biogenic carbon is converted in landfills to methane, not CO_2. Under the life cycle methodology the impact of the methane emissions is adjusted downwards by an amount equivalent to the GWP associated with the emissions of CO_2 from the amount of carbon in the emitted methane. This approach results a smaller credit to the landfill emissions than that applied to account for the sequestration effects. For example:

- For food waste landfilled in Austria with a methane emission of 33 kg the credit for the biogenic carbon emitted as methane is 91 kg CO_2 equivalent;
- For paper landfilled in Spain with a similar methane emission of 32 kg the credit for the biogenic carbon emitted as methane is 89 kg CO_2 equivalent.

Cost Benefit Approach

Where the cost benefit methodology is used, the model applies a discount rate for time delayed emissions such as those from landfill. This approach includes the biogenic CO_2 emissions and so there is no need to make allowance for sequestration (long-term storage).

The cost benefit methodology considers air quality impacts as well as the climate change impacts. Whilst landfill gas is principally comprised of methane and carbon dioxide, approximately 1% of the volume of the gas is made up of trace elements. This can include

up to 150 substances including halogenated organics, organo-sulphur compounds and aromatic hydrocarbons depending on the nature of the waste.[36]

The gases which are emitted in any one year are assumed to be related to the quantity of methane or CO_2 produced, depending upon whether one is considering raw gas or gas once combusted – as is shown in Table 3-25. Methane emissions to the atmosphere and methane emissions captured are both used to estimate, on a proportional basis, emissions of different trace gases in a given year using the relative composition of gas outlined in below. The way this is done is to normalise the concentrations (by weight) so that:

- Where gas is flared (i.e., captured but not used for energy generation), the emissions of other gases are calculated with reference to the studies by Enviros et al and White et al. The way this is done is by calculating the CO_2 content of flared gas and calculating the emissions of other gases through the quantities relative to CO_2 as specified in the two studies mentioned;
- A similar approach is used to calculate fugitive emissions, but in this case, the other emissions are calculated relative to the calculated quantity of methane emissions; and
- For gas which is emitted from the gas engine following its utilisation for energy generation, the emissions of other gases are calculated using the quantities estimated in other studies relative to calculated CO_2 emissions.

Table 3-25: Non Greenhouse Gas Emissions to Air from Landfilling

	Emissions mg/Nm^3 landfill gas			Source
	Fugitive Ratio to CH_4	Flaring Ratio to CO_2	Energy generation Ratio to CO_2	
Methane	1	0.001818	0.005714	Enviros
Carbon dioxide	1.733333	1	1	Enviros
Carbon monoxide	3.03E-05	4.09E-04	4.09E-04	White et al
Hydrogen sulphide	4.66E-04	1.69E-08	1.69E-08	White et al
Hydrogen chloride	2.67E-06	8.64E-05	1.14E-05	Enviros
Hydrogen fluoride	5.33E-07	1.82E-05	1.14E-05	Enviros
Chlorinated HC	8.10E-05	5.10E-06	5.10E-06	Enviros
Dioxins and furans	0	3.36E-13	5.43E-13	Enviros
Total Particulates	0	3.64E-05	0.00002	Enviros
Nitrogen oxides	0	0.000455	0.002571	Enviros
Sulphur dioxide	0	0.000545	0.0002	Enviros
Cadmium	0	0	2.86E-07	Enviros

[36] Komex (2002) Investigation of the Composition and Emissions of Trace Components in Landfill Gas, R&D Technical Report P1-438/TR for the Environment Agency, Bristol

	Emissions mg/Nm^3 landfill gas			Source
	Fugitive Ratio to CH_4	Flaring Ratio to CO_2	Energy generation Ratio to CO_2	
Chromium	7.12E-08	1.25E-08	1.25E-08	White et al
Lead	2.00E-08	2.49E-09	2.49E-09	White et al
Mercury	1.41E-08	2.49E-09	4.57E-09	Enviros
Zinc	1.68E-07	6.64E-11	6.64E-11	White et al
Nickel	0	0	3.71E-08	Enviros
Arsenic	0	0	4.57E-09	Enviros
Total VOCs	0.000333	7.73E-06	0	Enviros
Non-methane VOCs	0	8.64E-06	8.57E-05	Enviros
1,1-dichloroethane	0.000036	0	0	Enviros
Chloroethane	1.33E-05	0	0	Enviros
Chloroethene	1.47E-05	0	0	Enviros
Chlorobenzene	0.000032	0	0	Enviros
Tetrachloroethene	0.000044	3.64E-08	5.71E-07	Enviros
Poly-chlorinated biphenyls	0	0	0	White et al
Benzene	3.2E-06	0	0	Enviros

Source: Adapted from White P R, Franke M and Hindle P (1995) Integrated Solid Waste Management: A Lifecycle Inventory, Blackie Academic & Professional, Chapman and Hall; Enviros, University of Birmingham, RPA Ltd., Open University and Thurgood M (2004) Review of Environmental and Health Effects of Waste Management: Municipal Solid Waste and Similar Wastes, Final Report to Defra, March 2004

There are some inconsistencies in this approach, the principal one being that the White et al data make little allowance for changes in the level of oxidation of methane through the cap of the landfill site. Our model incorporates this as a variable. It is important to appreciate here that oxidation may appear not only at the cap (and typical estimates in the literature are 10%), but also in the leachate, so that total oxidation of methane to carbon dioxide may be greater than is sometimes suggested.

Landfills produce less of the pollutants for which dose response functions are tolerably well known. No external damage costs have therefore been developed for many of pollutants listed in Table 3-25. These figures include impacts associated with the use of diesel at the facility, and a small amount of avoided emissions resulting from the generation of electricity from landfill gas.

Energy Generation

For landfilled wastes, avoided impacts relate solely to energy generation from captured landfill gas, as no recyclate is recovered through the process. The amount of energy generated is directly related to the amount of landfill gas that is generated and subsequently captured. Assumptions used with regard to the generation of electricity from landfill gas are presented in Table 3-26.

Table 3-26: Assumptions Used for Electricity Generation from Landfill Gas

Parameter	Value
Proportion of landfill gas used to generate energy	50%
Gas engine efficiency	35%
Calorific value of methane	38 MJ / kg

The proportion of methane contained within landfill gas varies by member state, depending on the assumptions contained in the National Inventory Reports. For most member states, it is assumed that 50% of the carbon contained in waste forms methane, although several (the Netherlands and the Czech Republic) assume 60%, whilst Denmark assumes the same proportion is 45%.

3.1.5.8 Incineration

Emissions to Air

Greenhouse gas emissions occurring as a result of the incineration of waste will be dependent upon the carbon content of the dry material, along with the overall efficiency of energy generation that results from the combustion of that material. As such, climate change impacts are directly dependent on the outputs from the Mass Flow Module for each Member State. Table 3-27 presents the assumptions used in the model in respect of the carbon content of waste materials.

N_2O emissions are modelled based on previous research undertaken by Eunomia on behalf of WRAP.[37] The considerable uncertainty with respect to these emissions is acknowledged within the EU BREF note, which provided a range of 5.5 – 66 g N_2O per tonne of waste treated by the facility.[38] We use the mid-point of these values within the current analysis. CH_4 emissions are negligible from incineration facilities.

[37] Eunomia (2007) Emissions of Nitrous Oxide from Waste Treatment Processes, Report to WRAP, July 2007

[38] European Commission (2006) Integrated Pollution Prevention and Control: Reference Document on Incineration, August 2006

Table 3-27: Carbon Content of Waste Materials

Waste Category	Carbon content, % fresh matter	
	Biogenic	Fossil
Biowastes	16%	
Food	13%	
Garden	18%	
Other biowastes	16%	
Wood	32%	
Wood packaging	32%	
Other wood	32%	
Paper / Cardboard	32%	
Non-packaging paper	32%	
Packaging paper	32%	
Cardboard	31%	
Textiles	15%	
Clothing and footwear	15%	15%
Other textiles	5%	25%
Glass		
Metals		
Plastics		60%
Plastic bottles		60%
Other rigid plastic packaging		60%
Non-packaging rigid plastics		55%
Film packaging (bags etc)		56%
Non-packaging films		56%
WEEE		5%
Large household appliances		5%
Small household appliances		5%
IT and telecommunications equipment		5%
Toys, leisure and sports equipment		40%
Other		
Rubble, soil		
Furniture	10%	10%
Batteries and accumulators		
Other wastes		
ELVs		
Haz (exc WEEE)		
Fines	7%	
Inerts		
Other	9%	8%

When analysis of pollution impacts is undertaken using the damage cost approach, typically the most significant contribution to the total pollution impacts comes from the NOx pollution. The model therefore considers emissions from incineration facilities with SNCR

installed to control the NOx, and those that use SCR. Emissions data for incineration facilities included in the model are detailed in Table 3-28.

Table 3-28: Emissions from Incineration Facilities

	Emissions to air, tonnes pollutant per tonne of material treated	
	Incineration with SNCR	**Incineration with SCR**
NH_3	1.46E-05	1.46E-05
NOx	0.000828	0.000214
$PM_{2.5}$	4.87E-06	4.87E-07
PM_{10}	9.74E-06	9.74E-07
SO_2	3.9E-05	9.74E-06
VOCs	3.9E-06	9.74E-07
Arsenic	8.77E-09	8.77E-09
Cadmium	9.74E-09	9.74E-09
Chromium	5.84E-09	5.84E-09
Nickel	7.79E-09	7.79E-09
Dioxins/furans	1.52E-13	1.52E-13

Sources: Information Centre for Environmental Licensing (2002) Dutch Notes on BAT for the Incineration of Waste, Report for the Ministry of Housing, Spatial Planning and the Environment, The Netherlands, February 2002; European Commission (2006) Integrated Pollution Prevention and Control: Reference Document on Incineration, August 2006; ExternE (1999) Externalities of Energy, Vol 10: National Implementation, prepared by CIEMAT for the European Commission, Belgium; Chang M B, Huang C K, Wu J J, and Chang S H (2000) Characteristics of heavy metals on particles with different sizes from municipal solid waste incineration, Journal of Hazardous Materials 79(3): pp229-239

Energy Use and Generation

The model assumes the incinerator uses 82 kWh of electricity per tonne of waste and 3 litres of diesel in line with values seen in several literature sources as well as recent permit applications for proposed incineration plant in the UK.[39]

As is the case with the climate change emissions from the incineration process, the energy content of the residual waste treated by the plant is directly linked to the composition of the feedstock. Table 3-29 presents assumptions used in the model in respect of the calorific values of waste materials. The data presented is the net calorific value as received by the plant.

The model separately considers the performance of four types of incineration plant:

- Facilities generating only electricity;

[39] Riemann I (2006) CEWEP Energy Report (Status 2001-2004): Results of Specific Data for Energy, Efficiency Rates and Coefficients, Plant Efficiency Factors and NCV of 97 European W-t-E Plants and Determination of the Main Energy Results, updated July 2006; VITO (2000) Vergelijking van Verwerkingsscenario's voor Restfractie van HHA en Niet-specifiek Categorie II Bedrijfsafval, Final Report

- Plant generating electricity and exporting heat for use outside the plant;
- Facilities exporting only heat;
- Incineration plant combusting waste without utilising the energy that is generated through the combustion process.

The model has been set up so that different assumptions regarding generation efficiencies for each of the four types of plant can be made for each Member State; in addition, there is scope for these efficiencies to vary annually from 2011 to 2030 where such data is available for individual Member States.

Table 3-29: Calorific Values of Waste Materials

Waste Material	Calorific value, MJ / kg fm (as received)
Biowastes	6
Food	5
Garden	8
Other biowastes	6
Wood	15
Paper / Cardboard	12
Non-packaging paper	12
Packaging paper	12
Cardboard	12
Textiles	13
Clothing and footwear	13
Other textiles	13
Glass	
Metals	
Mixed cans	
Steel cans	
Aluminium cans	
Aluminium foil	2
Other scrap metal	
Plastics	34
Plastic bottles	34
Other rigid plastic packaging	34
Non-packaging rigid plastics	30
Film packaging (bags etc)	32
Non-packaging films	32
WEEE	3
Large household appliances	3
Small household appliances	3
IT and telecommunications equipment	3
Toys, leisure and sports equipment	25
Other	
Rubble, soil	
Furniture	10

Waste Material	Calorific value, MJ / kg fm (as received)
Batteries and accumulators	
Other wastes	
End of life vehicles	
Hazardous waste	
Fines	3
Inert	
Other	14

Sources: Phyllis Database for Biomass and Waste, available from http://www.ecn.nl/phyllis/; Beker D and Cornelissen A A J (1999) Chemische Analyse Van Huishoudelijk Restafval: Resultaten 1994 en 1995, National Institute of Public Health and the Environment, Nederland; Davidsson A, Gruvberger C, Christensen T, Hansen T and la Cour Jansen J (2007) Methane Yield in Source-sorted Organic Fraction of Municipal Waste Management, Waste Management 27 pp.406-14; Komilis D, Evangelou A, Giannakis G, Lymperis C (2012) Revisiting the elemental composition and the calorific value of municipal solid wastes, Waste Management, 32(3), pp372-381

Where no data was provided by MS on the efficiency of incineration facilities the model uses the default assumptions for energy generated at incineration plant presented in Table 3-30. This data was confirmed as being a reasonable representation of typical operating efficiencies for European plant through consultation with the European Suppliers of Waste to Energy Technology (ESWET) and the Confederation of European Waste to Energy Plants (CEWEP). Some member states provided specific information as to the efficiency of their plant; where this was the case, the data was incorporated into the model.

Table 3-30: Energy Generation Efficiencies for Incineration Plant – Default Values

	Gross electricity generation efficiency (% exported of total energy content)	Heat utilisation (% heat used of total energy content)
Electricity only	25%	-
CHP	14%	42%
Heat only	-	80%

Recycling

The efficiency with which metals are recovered from incineration facilities is modelled based on a recent literature review undertaken by Grosso et al, which suggested that 70% of the ferrous metal could be recovered as well as 30% of the non-ferrous metal.[40] The materials recovery is assumed to result in offset emissions as described in Table 3-19.

[40] Grosso M, Biganzoli L and Rigamonti L (2011) A Quantitative Estimate of Potential Aluminium Recovery from Incineration Bottom Ashes, Resources, Conservation and Recycling, 55, pp1178-1184

The mass flow model also assumes that bottom ash is also recovered for recycling. However, this results in only negligible environmental benefits and as such this has not been included in the environmental model.

Landfilled Residues

Air pollution control residues from waste incineration facilities consist of a mix of unspent reagents and chemicals extracted from the flue gas. They are typically treated as hazardous waste and are usually required to be sent to hazardous waste landfills. Chlorine, sulphur, heavy metals and dioxins are likely to be concentrated in the air pollution control residues produced by incinerators. Ironically, the better flue gas cleaning systems perform, the more likely it becomes that toxic materials are concentrated in these residues.

Several recent studies indicate that long-term impacts of landfilling this hazardous material may be significant. In a Dutch study comparing the costs and benefits of landfill with those of incineration, the environmental damages associated with air pollution control residues were considered as the most important externality associated with treatment in an incineration facility.[41]

One life-cycle study suggests:

> *'The evaluation of waste incineration technologies largely depends on the assessment of heavy metal emissions from landfills and the weighting of the corresponding impacts at different points in time. Unfortunately, common LCA methods hardly consider spatial and temporal aspects."*[42]

Using a geochemical model to model some pollutants, the same study concluded:

> *'Landfills might release heavy metals over very long time periods ranging from a few thousand years in the case of Cd to more than 100,000 years in the case of Cu. The dissolved concentrations in the leachate exceed the quality goals set by the Swiss water protection law (GSchV) by a factor of at least 50.'*

We have not included these impacts in our model due to the limited data associated with their impacts, and the long timescale over which such impacts might be expected to occur.

3.1.5.9 Mechanical Biological Treatment

The following types of MBT facility have been included in the model, reflecting the most commonly used approaches:

- The stabilisation of the degradable fraction to reduce impacts from landfilling;
- Biodrying to produce a fuel subsequently used in an incinerator;
- Processes that use AD to treat the biodegradable element of residual waste; and

[41] Dijkgraaf E and Vollebergh H (2004) Burn or Bury? A Social Cost Comparison of Final Waste Disposal Methods, Ecological Economics, 50: pp233-247

[42] Hellweg S (2000) Time- and Site-Dependent Life-Cycle Assessment of Thermal Waste Treatment Processes, Dissertation submitted to the Swiss Federal Institute of Technology

- Processes that only undertake the mechanical element of the MBT process to recover recyclate from the residual waste, termed in the model as a Residual MRF facility.

Each type of MBT has different environmental impacts associated with it. Given the summary nature of this overview the details will not be summarised here. Instead the reader is referred to the technical documentation that accompanies the EU waste model.

3.1.6 Employment Module

The aim of the Employment Module is to derive figures for the rate of employment per tonne of waste managed in different waste management operations (e.g. collection, landfilling, incineration, etc.). A graphical overview of the Employment Module is provided in Figure 3-9 which shows how it is linked to the Mass Flow Module outlined above. Employment in waste management is given in terms of number of full time equivalent (FTE) jobs per 10,000 tonnes of waste processed (also referred to as 'employment intensity'). These employment intensity factors are scaled in the model by the quantity of waste managed in different ways to derive:

- An estimate of employment in a particular waste management projection; and
- An estimate of the net impact on employment from one scenario compared to another.

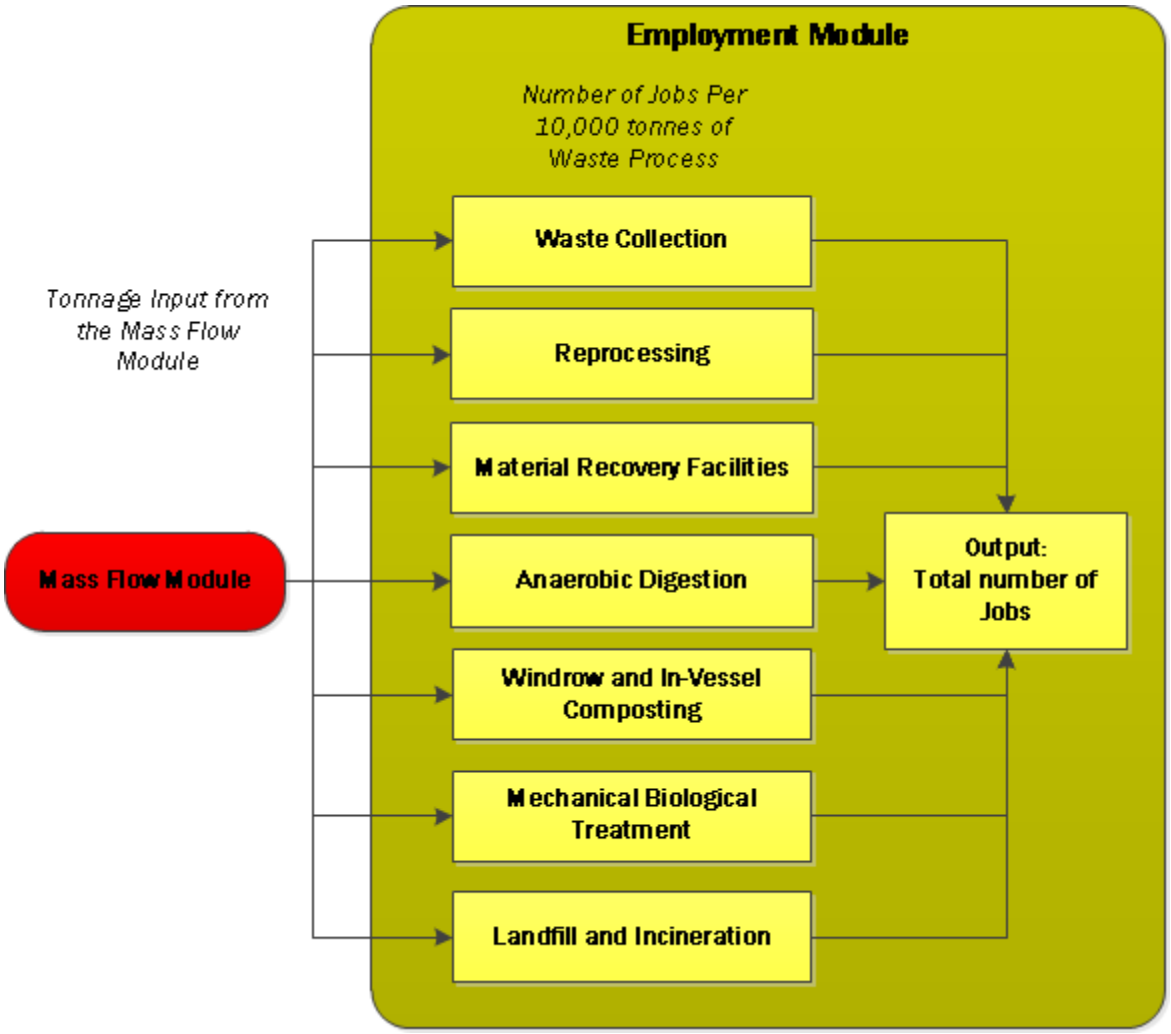
The OECD has previously recognised the intrinsic difficulties in the analysis and interpretation of employment data in the waste management industry.[43] An issue of particular salience relates to the difficulties that arise as a result of the industry's heterogeneous nature. This makes direct comparisons between studies less justifiable. Methodological inconsistencies within the literature exacerbate this issue, and are discussed further below. In recognition of the limitations inherent to the existing literature, a survey micro study was also conducted into employment in waste management facilities.

As shown in Figure 3-9 this Module takes into account employment in relation to the following:

- Reprocessing;
- Material Recovery Facilities;
- Anaerobic Digestion;
- Windrow and In-Vessel Composting;
- Mechanical Biological Treatment:
- Landfill and incineration; and
- Waste Collection.

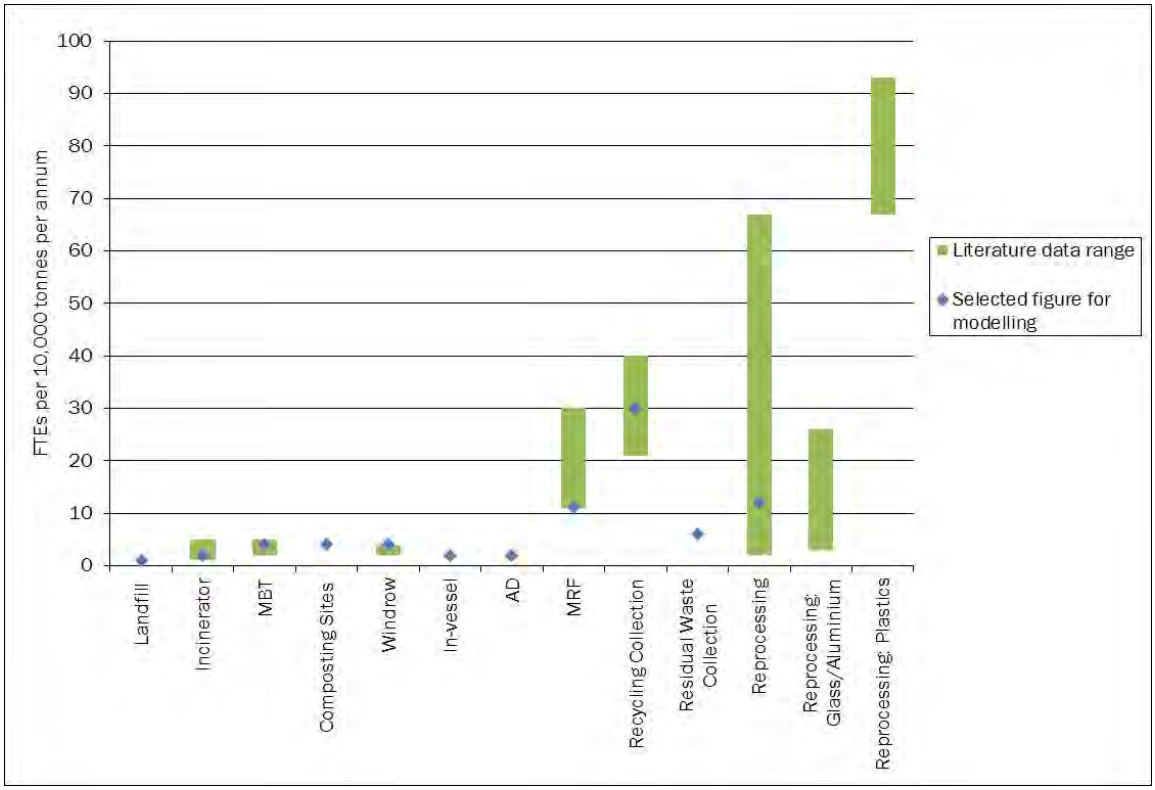
[43] OECD (1996) *The Global Environmental Goods and Services Industry*, Paris, OECD.

Figure 3-9: Overview of the Employment Module



A summary of the research that was conducted to substantiate the employment intensities for each of the above is included in the documentation that accompanies the European Reference Model on Waste. The results of this research are shown in Figure 3-10 which identifies the employment intensity values which were used in the model.

Figure 3-10: Range in Employment Intensities from Literature Review and Selected Figures for Modelling



3.1.7 Costs-Benefit Analysis Results

This component of the model collates the results coming out of the Environmental Impacts Module and the Financial Costs Module and presents the information in the form of easy to interpret charts and graphs.

3.1.8 Distance to Targets

For any model run, this component of the model calculates the distance that each Member State is from the targets set out in the following European waste Directives:

- Landfill Directive Article 5(2) targets;
- Waste Framework Directive Article 11(2)(a) target;
- Packaging and Packaging Waste Directive Article 6(1) targets; and
- WEEE Directive Article 7(1) target.

The results of these analyses can be very helpful as reference to identify if the option being modelled will allow the Member State to meet the above targets.

3.1.9 Resource Efficiency Indicators

One intended purpose of the European Waste Model was to be able to use it to track a number of 'Resource Efficiency Indicators' (REIs) relating to waste and material management in the European Union. One of the key model output therefore includes a summary of the following seven REIs:

1. ***Per Inhabitant MSW Generation***
   The model can report on waste generated per inhabitant. In seeking to ensure that by 2020 waste per inhabitant is in absolute decline, a clear issue is that different countries currently have different waste generation per inhabitant, and these differences are likely to persist, to varying degrees, over coming years. As such, the intent ought to be to maintain municipal waste per inhabitant below a certain level. However, this approach can be complicated by the fact that wastes of varying scope can be included under the definition 'municipal'.

2. ***Recycling Rate (dry)***
   Where 'dry' (i.e. materials other than food waste and garden waste) materials are concerned, the recycling rate is a useful indicator of performance in respect of resource efficiency.

3. ***Residual Organic Waste per Inhabitant***
   Where wet materials are concerned, the recycling rate is susceptible to significant influence depending upon the approach to collecting waste. For example, where garden wastes are separately collected free of charge, in suburban areas, this can increase recycling rates significantly, even where some of this material might not otherwise have needed to be collected and been managed within the home (so would not have arisen as waste). It is be more appropriate, therefore, to estimate the quantity of organic waste which is not separately collected for composting or anaerobic digestion. This gives an indication of how much uncaptured organic waste there is in the residual waste stream, and thus indicates the effectiveness of approaches to prevention and source separation.

4. ***Residual Waste per Inhabitant***
   A measure already considered in certain countries / regions, is the quantity of residual waste per inhabitant. The merit of this indicator is that it captures the extent to which waste has move into the upper tiers of the hierarchy, and no longer requires management as residual waste. To the extent that the Roadmap seeks to ensure that only non-recyclable waste is incinerated (or, presumably, sent to MBT, or landfilled, etc.), then this indicator captures both the recycling efforts and the efforts made in respect of waste prevention. It may also be considered also a 'fair' indicator in comparing Member States.

5. ***Proportion of Waste Landfilled***
   Although aligned with the Roadmap's vision, the merits of whether this is a suitable indicator of performance are less clear than some of the other indicators included in the model. Nevertheless, since it is straightforward to calculate, it is reported through the model.

6. ***GHG Savings Relative to Hypothetical Maximum***
   A further interesting measure of resource efficiency is to estimate the GHG savings from the management of waste relative to what would be achieved if 100% of the dry material was recycled, 100% of the food waste was digested, and 100% of the

garden waste was composted.[44] This gives an indication of how close the existing system is to the maximum GHG savings. In calculating this indicator, the modelled impact from landfilling needs to assume that all emissions associated with the landfilling of waste are assigned to the year in which they are deposited. However, in principle, this gives a useful proxy for the 'resource efficiency' of the waste management system. It may be noted that a similar approach has been used in respect of setting recycling rates in Scotland, where a carbon metric is used to calculate recycling rates.

7. ***Municipal Material Captured for Recycling vs Material used in the EU***
It would be of interest to consider the impact of recycling on the consumption of raw materials. In principle, although recycling will reduce the consumption of raw materials, it might not necessarily do so within the EU. Considerable quantities of material are exported for recycling either within the EU (intra-EU trade) or to non-EU countries (extra-EU trade). Without detailed knowledge and understanding of the flows of imports and exports of secondary materials, the extent to which recycling reduces the EU's import dependency is not clear.

   In the absence of this type of information, therefore, the principle, indicator which could inform the value of improved waste management is

   > *"The quantity of material captured for recycling relative to the quantity of the same material used in the EU."*

   Evidently, this is somewhat artificial where the model does not include all waste streams. Where materials arise principally as **industrial** wastes, for example, the proportion of overall demand which could be met by the recycled **municipal** waste material is unlikely to be especially high. Nevertheless, as a comparative indicator (i.e. to assess changes over time or between scenarios), and to indicate the contribution to total material demand, we include the above indicator in the model.

[44] We note that 100% recycling of all materials might not be considered possible, but this does serve to highlight the closeness to a hypothetical maximum without entering into discussion regarding what 'maximum rates' of recycling might be (noting also that views on 'maximum rates' seem to be increasing over time).