

Partial Regulatory Impact Assessment of the Review of England's Waste Strategy

February 2006



Contents

Introduction and Summary	1
New Policy Proposals.....	1
Purpose and intended effect	2
Objective.....	2
Background	2
Rationale for policy.....	3
Consultation	3
Within Government.....	3
Public consultation	3
Options and Proposals	4
Option A: “No policy change”	4
Option B: Simplifying the regulatory framework.....	5
Option C: Waste prevention initiatives	5
Option D: Extending the sectoral approach	6
Option E: National household waste recycling targets	6
Option F: Local Authority performance standards for recycling.....	6
Option G: Greater recovery of energy from waste	6
Option H: Over-arching procurement strategy for municipal waste.....	6
Option I: Wider role for local authorities in non-municipal waste.....	6
Option J: Better collection and management of household hazardous waste.....	7
Option K: Extend producer responsibility to priority hazardous waste streams	7
Option L: Targeted action on illegal waste management.....	7
Sectors and groups affected	7
Costs and benefits	8
Cost benefit analysis	8
Qualitative assessment	9
Option A: “No policy change”	9
Option B: Simplifying the regulatory framework.....	9
Option C: Waste prevention initiatives	10
Option D: Extending the sectoral approach	10
Option E: National household waste recycling and composting standards.....	11
Option G: Greater recovery of energy from waste	12
Option H: Over-arching procurement strategy for municipal waste.....	13
Option I: Wider role for local authorities in non-municipal waste.....	13
Option J: Better collection and management of household hazardous waste.....	14
Option K: Extend producer responsibility to priority hazardous waste streams	15
Option L: Targeted action on illegal waste management.....	15
Other Impacts and Equality and Fairness	16
Equality and Fairness	16
Health Impacts	17
Small Firms Impact Test (SFIT)	17
Competition assessment	18
Enforcement, sanctions and monitoring	18
Annex A - Municipal waste	19
Option A: Municipal waste base case, “No policy change”	19
Municipal waste data.....	19
Municipal waste forecasts	20

Assessment of base case scenarios.....	20
Costs and benefits.....	22
Costs	22
Benefits	23
Annex B – Commercial, Industrial & Hazardous waste	24
Option A: CI&H waste base case, “No policy change”	24
CI&H waste forecasts.....	27
Environment Agency targets on PPC regulated industries.....	27
Chemical sector voluntary reduction target.....	27
Impact of landfill tax.....	28
Landfill Directive requirements.....	28
Assessment of base case scenario.....	29
Costs and benefits.....	33
Annex C - Producer responsibility scheme for waste lubricating oil: assessment of impacts and costs.....	37
Background	37
How would a PR system work?.....	38
Annex D - Policy web	40
Annex E - Competition test	45
Annex F - Existing or forthcoming RIAs considered in waste strategy review.....	46
Annex G - Details of scenario calculations underpinning some options	48
Municipal waste.....	48
Option E: National household waste recycling and composting targets	48
Commercial and Industrial waste	54
Annex H - Environmental modelling	57
CI&H Assessment	59
Annex I - The Local Authority Waste Recycling Recovery and Disposal (LAWRRD) Model.....	61
Annex J - Commercial and Industrial waste forecasting.....	64
REEIO	64

Partial Regulatory Impact Assessment of the Review of England's Waste Strategy

Introduction and Summary

1. This partial Regulatory Impact Assessment (pRIA) forms part of the consultation on proposals for a revised waste strategy for England. It accompanies a consultation document *Review of England's Waste Strategy* and a separate *Environmental Report* from a strategic environmental assessment of the proposals.
2. The consultation document:
 - a. sets out the progress made since 2000 in meeting the Government's objectives and implementing its policies with respect to waste;
 - b. consults on proposals to revise the objectives of the current strategy and the policies for implementing it.
3. The revised strategy will be designed to deliver the Government's objective for waste within its overall strategy for sustainable development. It also forms part of the "Waste Management Plan" which the UK is required to have under Article 7 of the European Framework Directive on Waste and sets out its strategy for implementing its obligations under this and other European waste-related Directives, including those on hazardous waste, packaging and landfill.
4. The revised waste strategy will consolidate current policies and set out new proposals agreed after consultation.

New Policy Proposals

5. The consultation document includes a range of suggestions and proposals on which it seeks views. This pRIA assesses the impacts, costs and benefits of the 11 main proposals (Options B to L) against the base case of continuing with current policies (Option A). The options focus on using existing policy instruments and spending programmes to improve waste management performance.
6. The first Option (B) is a proposal for simplifying part of the waste regulatory system – building on the work already being done in the Environment Permitting Review. This is expected to reduce regulatory burdens.
7. Other Options (C, D, I and K) envisage working with business on a voluntary basis and with some Government financial support to improve resource efficiency, reduce waste and recover more value from the waste that is produced. Particular help is proposed for small businesses.
8. Other Options (E, F, G, H, and J) are designed to help local authorities implement as cost effectively as possible the requirements of existing European Directives. These include new national recycling targets and help to increase energy recovery to meet the Landfill Directive and Packaging Directive targets.

9. No new regulations on business are proposed. Action to help business comply with existing legislation and strengthen enforcement is contained in Option L.

10. Among the Options and sub-options assessed are alternatives to the preferred approach set out in the consultation document. Options are not preferred where the costs do not justify the benefits, where it has not yet been possible to assess the costs and benefits or where a new regulatory burden would be imposed without seeking a voluntary approach first.

11. Accordingly, the consultation document does not propose any options which would increase regulatory burdens.

Purpose and intended effect

Objective

12. The Government set out its strategy for waste management in England in *Waste Strategy 2000*. The overall objective of *Waste Strategy 2000* is to reduce the impacts of waste management on the environment, while developing the economic benefit of using waste as a resource and meeting the requirements of European legislation.

13. The objective of the review is to reflect on existing policies and delivery mechanisms, including those arising from the Government's response to the recommendations made in the Prime Minister's Strategy Unit report on waste, *Waste not Want not*, and to consult on proposals for a revised waste strategy to supersede *Waste Strategy 2000*.

Background

14. *Waste Strategy 2000* responds to the requirement under Article 7 of the EU Framework Directive on Waste (75/442/EEC of 15 July 1975, as last amended by Directive 91/692/EEC) (the Waste Framework Directive) for a national plan for the management of waste. It sets out the Government's 20 year strategy for waste management in England together with targets and measures to support its objectives.

15. Much progress has been made as a result of *Waste Strategy 2000*, including a considerable increase in the recycling and composting of household waste and in the development of markets for recovered materials. At the same time, diverse EU Directives and national policies have been implemented - notably the EU Directive 1999/31/EC on the landfill of waste (the Landfill Directive) - which are radically altering the waste management landscape. The recent EU Thematic Strategy on the prevention and recycling of waste and the Government's strategy for sustainable development, *Securing the Future*, now further add to this evolving landscape by placing waste management firmly within the context of sustainable resource use.

16. Against this background, *Waste Strategy 2000* is widely regarded as requiring updating and needing a new strategic focus to drive waste management through this evolving agenda. The review therefore provides Government the opportunity to draw together the diverse policy and European developments and stakeholder opinion into a coherent framework for the future. It reassesses assumptions made since 2000 about costs, growth in waste and potentially achievable recovery and recycling rates based on new data, advancements in technology and a better understanding of the environmental, economic and social impacts of dealing with waste, and establishes a progressive agenda for waste and resource management coherent with the Government's drive for sustainable development.

Rationale for policy

17. The rationale for our policy (and the European policies which it must deliver) remains the reduction of the environmental and health impacts of waste in particular:

- to reduce the impact of waste on climate change;
- to conserve limited natural resources; and
- to reduce risks to health and the environment from potentially harmful substances within waste.

Key issues to be dealt with include a closer integration in policy between waste and sustainable consumption and production; the optimum framework of targets for recycling, composting, and energy recovery; and integrating the approach to municipal and non municipal waste streams.

18. It is proposed that the revised waste strategy, like *Waste Strategy 2000*, will set a 20 year vision but, given the pace of change and market evolution, be monitored and reviewed.

Consultation

Within Government

19. The waste strategy review is being overseen by a Programme Board which includes representatives of other key departments (DTI, ODPM, Cabinet Office and HMT) as well as Defra and the Environment Agency.

Public consultation

20. Defra has consulted widely with interested parties on the scope and key issues for the review. Stakeholder workshops took place in January, February and October 2005 and included representatives from Government agencies, local and regional governments, the waste management industry, waste producers, SMEs, financial institutions, consultancies, academics, environmental NGOs, the voluntary community and consumers groups. Bilateral consultations were also carried out and papers submitted by interested parties integrated in the overall thinking.

21. Defra has provided a consultation document on the strategy review with the aim of securing stakeholders' views on additional policy proposals and options that could

contribute to attainment of our waste strategy objectives. This consultation will commence on 14 February 2006 and remain open for a period of 12 weeks. Responses should be received no later than 9 May 2006.

22. Consultation specialists, Dialogue by Design, have been commissioned to manage the public consultation process. It will be largely web-based but pro-actively managed with letters being mailed to all key stakeholders to raise awareness of the consultation process. The consultants have developed a 'stakeholder map' to ensure that the full breadth of stakeholder interest is addressed.

Responses to pRIA

23. If you have any comment on the partial Regulatory Impact Assessment, please let us know via the online consultation website. You can register online at www.defra.gov.uk/environment/waste/strategy/review/ On registration you will be provided with a username and password to enable you to add to or change your submission as many times as you wish while the consultation is open. At the end of the consultation period all submissions will be grouped and collated. The website will display all submissions as well as provide a summary report.

24. Alternatively, if you wish to submit your comments on paper, or if you have special needs - or if you have any questions or queries on the consultation process - please contact Dialogue by Design, who are hosting this consultation on behalf of Defra, on 0208 683 6602 or facilitators@dialoguebydesign.com. For any other information on the review of *Waste Strategy 2000* please contact the Waste Strategy Review Team at Defra on 0207 082 8872 or wsrt@defra.gsi.gov.uk

Options and Proposals

25. This pRIA sets out an assessment of the principal measures proposed within the consultation document together with a re-assessment of continuing with current policies as a base line (Option A).

26. Any option that is agreed should be implemented, following the consultation, would be defined and assessed in more detail by individual RIAs. These RIAs would also assess the scope to simplify or remove existing regulatory requirements, in line with recommendations from the recent Hampton Review and *Less is More* report from the Better Regulation taskforce.

Option A: “No policy change”

27. In this option the revised strategy would simply consolidate *Waste Strategy 2000* policies and measures undertaken subsequently. This includes measures resulting from the progressive implementation of the Landfill Directive, the Pollution Prevention and Control Regulations 2000 and various Producer Responsibility

Directives, such as on packaging and packaging wastes, end of life vehicle, and waste electrical and electronic equipment¹.

28. This option implies a continuing and complex evolution of the current waste management landscape. The implications of this in terms of the key waste sectors of municipal solid waste (MSW) and commercial, industrial and hazardous (CI&H) wastes are set out in Annexes A and B respectively. The remaining options are possible new approaches for the revised strategy set out in the consultation document.

Option B: Simplifying the regulatory framework

29. The current regulatory framework requires some businesses to operate with both a waste management licence and a pollution prevention and control (PPC) permit, sometimes for the same site. Work to create a common permitting and compliance framework by combining these regimes is already underway, and detailed policy options around this new permitting regime for England and Wales will be consulted on early in 2006. This will include a detailed assessment of costs and benefits in its own RIA, and so is not considered further here.

30. Defra also proposes to open a review of the exemptions from waste management licensing with the primary objective of providing for a more risk-based approach to deciding which activities should be exempt in the future and which would be better regulated under a licence. The review will identify criteria on which to make decisions about providing for exemptions, one of which will be to encourage re-use, recycling and recovery activities that pose a low environmental risk.

Option C: Waste prevention initiatives

31. This option comprises a number of approaches, set out in Chapter 4 of the consultation document, to encourage waste prevention as part of the wider sustainable consumption and production agenda. These include initiatives to:

- a. Identify and prioritise **products** with the most significant impacts;
- b. extend product stewardship by producers and retailers, and reduce waste impacts through **eco-design**;
- c. promote **re-use and remanufacture** with support from the BREW programme;
- d. further **engage businesses** (including SMEs) to stimulate resource efficiency; and
- e. provide advice to consumers (business and the public) on environmental impacts of products.

32. These initiatives are intended to prevent waste from being generated in the first place by looking across the life cycle of products and services, from design and production through to consumption and end-of-life management.

¹ Measures brought forward since *Waste Strategy 2000* have been (or are being) subject to individual partial and full RIAs. These are listed in Annex F.

Option D: Extending the sectoral approach

33. This option looks to extend existing work at the sector level to reduce production waste, to increase recycling and recovery of wastes that are produced, and to reduce the waste that is landfilled.

34. The approach would seek voluntary agreements with businesses and sectors, using existing regulatory requirements, such as PPC, where appropriate. Only if this appears likely to fail would the possibility of statutory approaches be considered at a later stage.

Option E: National household waste recycling targets

35. The consultation document proposes to set national household waste recycling and composting targets of 40% by 2010, 45% by 2015 and 50% by 2020. These are based on the assessment in Annex A of what will be achieved under current policies to deliver the Article 5 requirements of the Landfill Directive to divert biodegradable municipal waste from landfill. These targets are therefore part of Option A (no policy change).

36. Option E considers setting higher national household waste targets. These could, in theory, be set for the later part of the strategy period (2015 and 2020). However, this is not the Government's preferred option.

Option F: Local Authority performance standards for recycling

37. This option proposes setting future household waste recycling performance standards for individual local authorities in order to assist delivery of national targets and to ensure a minimum common level of service across the country. There are a number of possible alternative approaches to the framing of such standards.

Option G: Greater recovery of energy from waste

38. This option is to support the greater recovery of energy from residual combustible wastes and to get the right balance between dedicated waste from energy facilities, co-firing with other solid fuels and use by large industrial users.

Option H: Over-arching procurement strategy for municipal waste

39. The proposal is for an overarching procurement strategy for municipal waste which strengthens central and regional co-ordination with clearer advice on procurement and funding options for local authorities including collaborative options.

Option I: Wider role for local authorities in non-municipal waste

40. This option would see local authorities (in partnership with others locally and regionally) facilitate a more integrated approach to business and household waste management to develop collection services and markets for recycled materials.

41. **Option I1** would see this role developed on a voluntary basis by local authorities with some financial support from central Government.

42. **Option I2** would see new duties on local authorities to offer a recycling collection services to businesses who wanted it. This is not the option the Government favours before the voluntary approach in Option I1 has been tested.

Option J: Better collection and management of household hazardous waste

43. This proposal is to achieve improved collection and appropriate management of hazardous waste in the household stream.

44. **Option J1** would be to issue guidance to local authorities requiring authorities to publish the service they provide, and specify a minimum level of service expected of local authorities to meet their current legal obligations.

45. **Option J2** would be to review and, if necessary, strengthen the legal requirements on local authorities to support the required minimum service level.

46. **Option J3** would be to extend the range of producer responsibility agreements or producer targets for recovery of specific household hazardous wastes, e.g. pesticides, cleaning agents or DIY chemicals.

47. The Government's preferred approach is Option J1 with consideration of J2 only if J1 looks likely to fail. Option J3 would be taken forward on a voluntary basis, and only if this appears likely to fail would the possibility of statutory approaches be considered.

Option K: Extend producer responsibility to priority hazardous waste streams

48. This proposal would seek to extend producer responsibility in respect of priority hazardous waste streams in order to achieve greater collection (avoiding inappropriate or illegal disposal) and increasing recycling or energy recovery. A first candidate might be waste lubricating oils (see Annex C). The approach would be to seek voluntary agreement with the producers. Only if this appears likely to fail would the possibility of statutory approaches be considered at a later stage.

Option L: Targeted action on illegal waste management

49. This proposal would see more resources targeted at waste crime prevention and greater enforcement action. The consultation document asks whether existing powers should be extended for use by a wider range of authorities.

Sectors and groups affected

50. The revised waste strategy will affect all sectors and groups including:

- a. businesses, as consumers, producers and retailers of products and generators of waste
- b. the waste management industry
- c. domestic consumers, as purchasers and waste generators
- d. voluntary and community organisations, as providers of services and in engaging communities in changing behaviour
- e. the public sector as a whole, as purchasers and waste generators
- f. local authorities, as local community leaders, and as responsible for waste management services in particular.

Costs and benefits

51. This section summarises the costs and benefits of the proposed options as set out above and described further in the consultation document. Each option has been assessed against a common base case of “no policy change” (Option A), i.e. business as usual. Where sufficient quantification is possible, estimates of the monetary cost and benefits are presented. Where this is not possible, a more qualitative assessment of costs and benefits has been undertaken.

Cost benefit analysis

52. Annex G sets out calculations for the costs and benefits of those options for which quantitative analysis has been possible. Monetised costs and benefits have been presented in terms of the discounted impact to society as a whole and in 2003/04 prices up to 2019/20².

53. MSW costs have been estimated using Defra’s LAWRRD model (Annex I). CI&H costs have been based on arisings data from the Environment Agency’s REEIO model (Annex J) and an assessment of treatment requirements, as illustrated for the base case in Annex B.

54. The monetised benefits are presented in terms of carbon savings. These are based on an assessment of climate change impacts as a proxy for total environmental impact. These benefits accrue as:

- direct benefits of reduced landfill emissions; and
- off-set benefits of recycling, recovery and greater resource efficiency within product life cycles.

These benefits have been monetised using the social cost of carbon³. The methodology is set out in Annex H⁴.

² A discount rate of 3.5% has been used in accordance with Treasury Green Book guidance

³ Clarkson, R. and Deyes K. (2002) *Estimating the Social Cost of Carbon Emissions*, Government Economic Service Working Paper 140, Defra and HM Treasury (£40/t low cost of carbon, £78/t medium, £153/t high)

⁴ This provides a conservative estimate of benefits, as wider environmental improvements in virgin materials reduction, resource utilisation and non-greenhouse gas impacts of materials production and consumption are not included.

55. The evaluation here is based on average factors derived from a life cycle assessment of greenhouse gas impacts of waste management⁵. However, these impacts are strongly dependent on the nature of wastes, the treatment routes and how off-sets are gained. The analysis should therefore only be viewed as providing a broad indication of the relative benefits compared to the base case of “no policy change”. The evaluation for CI&H wastes is less robust than that for MSW as less compositional data is available.

56. Moreover, the level of uncertainty in all modelling will grow over time. For example, new technology and innovation may impact on the future costs of policy implementation, making it difficult for the analysis to adequately predict actual costs and benefits. For some options, a range of costs has been used, reflecting different underlying assumptions about key variables (e.g. growth rates and pressure factors) and these are presented in this analysis. More detailed evaluation of costs and benefits should be undertaken in separate RIAs for those options taken forward following consultation.

Qualitative assessment

57. For some impacts, it has been concluded that valuation is not possible at this time. It is important that the non-valued impacts are taken into account when assessing the different policy options, rather than conclusions being drawn solely from the monetary analysis and other quantified impacts. The following impacts have been subject to qualitative assessment where applicable:

- social impacts;
- disamenity impacts from waste management facilities and flytipping; and
- competition and small business.

58. Local and global impacts are considered in more detail in the accompanying *Environmental Report*. This considers impacts on biodiversity, flora and fauna, human health, water and soil, air quality, and on cultural heritage and landscape.

59. A qualitative assessment of the overall impact of the waste strategy review proposals is given in the policy web in Annex D.

Option A: “No policy change”

60. The effects of current and already planned policies are set out in Annexes A and B for municipal waste and commercial and industrial waste respectively. The effects of the other options are assessed by comparison with this option.

Option B: Simplifying the regulatory framework

61. The results of this review are likely to lead to some activities currently requiring a waste management licence becoming exempt in the future, whilst others that currently benefit from an exemption will require a waste management licence. The cost and benefits of such changes will be subject to separate consultation and RIA,

⁵ ERM (2006) *Impact of Energy from Waste and Recycling Policy on UK Greenhouse Gas Emissions* Report to Defra - available at <http://www.defra.gov.uk/environment/waste/strategy/review/index.htm>

which will take account of parallel projects such as the Environmental Permitting Programme so that that regulatory control is more proportionate to the risk posed by the different waste recovery and disposal activities.

62. This review may particularly help smaller businesses (in the private or voluntary sector) as their activities are more likely to be in the lower risk categories.

Option C: Waste prevention initiatives

63. These measures are aimed at reducing waste impacts throughout the production and consumption cycle over the long term. Their effect is likely to be gradual but cumulative. Their success will be measured by reduced waste in both the business (commercial and industrial) and local authority (municipal) sectors.

64. The analysis in Annex G illustrates that if waste prevention measures targeted at the industrial sector led to a reduction in overall industrial waste growth by 0.75% per year to 2020⁶, this would yield benefits of between £440m and £975m as a net present value (Option C, Annex G). This would comprise both cost savings from reduced waste management infrastructure and the benefits from carbon savings from reduced emissions and energy and other resources saved⁷.

65. The costs will comprise central Government expenditure on programmes to identify priority products and support to assist businesses to “design out” waste, and the costs to business in making the changes. Current Government expenditure (under the BREW programme) is planned to be around £30m in 2006/07 to support such activities.

Option D: Extending the sectoral approach

66. The base case (Option A) already includes the effects of some existing voluntary sectoral plans being developed by the Environment Agency, including that with the Chemicals sector. This option includes specific proposals:

- a. by the Environment Agency in its draft new corporate strategy (2006-11) for a further target to reduce waste disposal by PPC regulated industry by 15%;
- b. the sector plan targets agreed with the Cement Industry⁸ to reduce the volume of cement kiln dust waste disposed, per tonne of cement manufactured, from 22.9kt in 1998 to 7.5kt in 2010, and to reduce all other waste disposal by 30% per tonne of cement manufactured over the same period.

⁶ i.e. reducing total CI&H wastes from a baseline of 82,290 kt in 2019/20 (Table B7) to 77,690 kt and preventing 43,210 kt over the period from 2002/03

⁷ However, the potential for waste prevention across all business sectors is much greater. It is estimated that the cost of wasted natural resources to UK manufacturing industry is equivalent to around 7% of profit (*The benefits of greener business* Cambridge Econometrics and AEA Technology www.environment-agency.gov.uk/business). Energy efficiency improvements by business and industry could save £12 billion annually across the UK economy (*The energy review* Performance and Innovation Unit report www.number-10.gov.uk/su/energy/1.html). The potential for realising these savings will be investigated further as part of the Sustainable Development Action Plan.

⁸ <http://publications.environment-agency.gov.uk/pdf/GEHO1105BJVI-e-e.pdf>

67. These agreements are estimated to deliver both environmental and economic benefits which together would amount to between £610m and £1.3bn as a net present value (Option D1, Annex G).

68. Development of further sector agreements would focus both on reducing waste but also increasing the amount of recycling and recovery from waste that is produced. The possible impacts of such agreements if they led to waste reduction are illustrated by Option C above. If they led to an increase in recycling of mixed commercial waste from 15% to 35% and an increase in food waste composting of 30% it is estimated that there would be environmental benefits and cost savings of between £260m and £1.1bn as a net present value (Option D2, Annex G).

Option E: National household waste recycling and composting standards

69. Option A is expected to deliver household waste recycling and composting levels of at least 40% by 2010, 45% by 2015 and 50% by 2020, which are the standards the consultation document proposes. Option E considers the impact of higher recycling levels. An option has been modelled that reaches 53% recycling by 2015 and 58% by 2020. (These are not the levels the Government is proposing in the consultation document and is not the Government's preferred option).

70. Option E incurs extra costs of over £770m (net present value). It shows additional environmental benefits valued at between £320m and £990m (net present value).

Option F: Local Authority performance standards for recycling and composting

71. The consultation document suggests alternative ways in which local authority standards could be set beyond 2007/08 to better incentivise recycling performance while giving authorities flexibility in achieving this. In particular, every local authority will have a role to play in increasing diversion of biodegradable municipal waste (BMW) from landfill in order to meet the requirements of the EU Landfill Directive.

72. Government is currently consulting on options to increase the minimum recycling level (the floor level) from the current 18% to 20% in 2007/08 (see Annex A). The impact of increasing this to 23% and 25% in 2010/11 (Options F1 and F2 respectively) is illustrated in Annex G.

73. Increasing the floor rate from 20% to 25% has a small impact on meeting the 2012/13 BMW target and has a marginal effect on the number, costs and distribution of facilities brought forward. However, increasing the floor above 25% has essentially no impact on behaviour as other policy instruments (LATS, landfill tax and packaging recovery targets) drive performance. Setting standards above this level risks interfering with other policy drivers, leading to an inefficient outcome.

74. Another way set out in the consultation document in which the standards could be modified is to alter the nature of the target to “household waste after recycling and composting”. If the standards were tonnage based this would have the benefit of providing some incentive to authorities to encourage the reduction of waste collected (e.g. through promotion of home composting). Cost and LATS provide some incentive to do this already but it is argued that current standards on recycling and composting can have the perverse incentive to collect more waste than can all be recycled. However such a tonnage based standard might be more complicated to set and measure, and for authorities and the public to understand.

75. A further way set out in the consultation document and in which the standards could be modified is to alter the nature of the target to apply to non-biodegradable waste only. The LATS scheme already encourages separate collection and recycling and composting of these waste streams. Focussing the target on non-biodegradable waste would ensure that there was a specific incentive for separate collection of other wastes (metals, glass, plastics). This could have the benefits of:

- a. gaining the environmental benefits from recycling these materials;
- b. facilitate the task of extracting packaging waste for recycling to reach our EU targets.

76. The disadvantages of this change could be:

- a. As the majority of non-biodegradable waste is waste covered by the packaging directive, this could transfer some part of the cost for recovering and recycling packaging waste from producers to local authorities;
- b. reduce the incentive for separate collection and recycling of biodegradable wastes (e.g. paper) as opposed to dealing with them through energy recovery; and
- c. make the measurement of the target more complicated.

77. Further consultation will be undertaken on the detail of any proposals for further statutory performance standards arising from this initial consultation. This will be accompanied by a more detailed pRIA.

Option G: Greater recovery of energy from waste

78. Option A already assumes that there will be an increase in recovery of energy from waste in both the municipal waste and commercial and industrial waste streams. This will be delivered in part by two new steps to support the market for refuse-derived fuel (RDF) produced by MBT plants. First the Government has started work under the Waste Implementation Programme to identify potential end users of RDF and to quantify the potential demand for it. Second, the Chancellor's 2005 pre-budget report announced the Government's intention to develop options for an enhanced capital allowance scheme to encourage investment in markets for the outputs of new waste treatment facilities, including for RDF. These should enable RDF to compete more fairly with other solid fuels.

79. Without these plans slightly less energy from waste would be delivered (110 kt/y in 2012/13) (Annex G, Option G1) and recycling/composting would need increase commensurately in order to achieve landfill allowance targets. This would result in

additional costs estimated at about £110m (net present value), but possible environmental benefits of between £30m and £80m⁹.

80. There is much public concern regarding the development of energy from waste. These concerns generally relate to potential health impacts from emissions and risks of capital-intensive facilities diverting waste from recycling and other actions higher in the waste hierarchy. However, the potential health impacts from modern facilities are small compared with other potential hazards¹⁰ and the balance of waste management options needs to be considered as part of an integrated approach to resource recovery. Government's view is therefore that energy from waste makes a valid contribution to the treatment of residual waste.

81. Government may therefore consider further targeted support for energy from waste to help inform decision-makers to properly consider this option. This could increase the amount of both the municipal waste and commercial and industrial waste streams going to such facilities. Option G2 (Annex G) illustrates that if such actions resulted in an increase in energy from municipal waste from 23% in the 2019/20 base case to 26% in 2019/20 (an additional 1,300 kt/y of capacity), this would result in cost savings of around £530m (net present value) and a reduction in environmental benefits of between £90m and £290m (net present value).

Option H: Over-arching procurement strategy for municipal waste

82. This proposal is to help local authorities procure services and facilities more efficiently. Option A already assumes cost effective solutions and, for instance, reasonable lead-in times to delivery of facilities.

83. The costs of this option are the staff and other resources to provide the co-ordination and support for local authorities. These are estimated to be of the order of £600k a year.

84. The benefits are to both local authorities and waste management companies. There should be cost savings in terms of bid and procurement costs as well as the costs of the contracts themselves. While these are difficult to quantify, in one recent case the total cost of a failed procurement exercise is estimated at over £50m¹¹.

85. There will also be benefits from faster delivery which will reduce the risk of the UK failing to meet its Landfill Directive targets.

Option I: Wider role for local authorities in non-municipal waste

86. The purpose of this option is to help businesses and public sector organisations (such as schools) to procure recycling and waste management services more cost-effectively, and to assist the market for recycled materials.

⁹ noting that recycling provides greater carbon savings than energy from waste (Annex H)

¹⁰ see *Review of the environmental and health effects of waste management* (2004)

<http://www.defra.gov.uk/environment/waste/research/health/index.htm>

¹¹ including additional costs incurred in re-tendering and greater waste management costs due to facility delays

87. The potential benefits will be:

- a. increased recycling and composting of commercial and industrial waste;
- b. cost savings to businesses (particularly smaller ones) and public sector organisations; and
- c. cost savings to local authorities waste management costs from potential economies of scale.

88. The environmental benefits of the first of these is set out in Option D. While there is limited evidence to quantify the second two there are examples of establishing recycling collection services for schools and offices that are no more expensive than the existing waste management services¹².

89. In **Option I1** this increased role would be undertaken on a voluntary basis by local authorities with some funding support from central Government, at least initially. The costs to local authorities (or central Government) would comprise staff resources and overheads. These are estimated at £200k - £250k per year for each authority or group of authorities¹³. If this were undertaken across England this could total £30m per year.

90. In **Option I2** new duties would be placed on local authorities. In the first of these they would be required to offer a recycling service to businesses. This would on a rechargeable basis so no additional cost should be incurred by authorities. Equally businesses would not be required to use the service, so no extra costs would be imposed on them.

91. Alternatively, recycling and composting targets for commercial waste could be imposed on local authorities. This would result in additional costs on local authorities if the targets were set at a level which meant they could only be met by offering the service to businesses at a less than cost price. There is insufficient evidence at present to assess the relative costs and benefits of different target levels. This would need to be considered in more detail if this option were to be pursued.

92. Option I1 is the Government's preferred approach.

Option J: Better collection and management of household hazardous waste

93. This proposal is intended to secure greater separate collection of household hazardous waste. This could achieve increased recycling of some hazardous materials and help to ensure safe disposal of hazardous material that cannot be recycled.

94. As increasing volumes of household waste are collected separately for recycling there may be an increasing concentration of hazardous substances in the remaining waste. This may give rise to problems with treatment options for residual waste (e.g. in landfill leachate and through concentration in incinerator bottom ash). There are,

¹² WRAP are currently piloting recycling services for small businesses which should provide further evidence of costs

¹³ Based on 4-5 staff at typically £50k per year (including overheads)

therefore, potential cost and environmental savings from increased separate collection.

95. **Option J1** would be to issue guidance to local authorities. This would be intended to secure a minimum standard across the country for duties for which authorities have already received increased funding as part of revenue support grant.

96. **Option J2** would be to review and potentially strengthen the legal requirements, if needed, to achieve a satisfactory minimum level of service. If this resulted in proposals for further duties on local authorities these would need to be assessed before any such proposals were taken forward.

97. **Option J3** would be to extend the range of producer responsibility for hazardous products, many of which end up in the household waste stream (e.g. decorative paints, garden pesticides). The costs and benefits of such an approach would need to be assessed for each product range before any such proposals were taken forward.

98. Of the first two options the Government's preferred approach is Option J1 with consideration of J2 only if this fails to deliver. Option J3 would be taken forward on a voluntary basis, and only if this looks likely to fail would the possibility of statutory approaches be considered at a later stage.

Option K: Extend producer responsibility to priority hazardous waste streams

99. The costs and benefits of this option will depend on the particular product or wastes to which producer responsibility is extended. A first potential candidate for this approach would be waste oils.

100. An initial assessment for waste oils is set out in Annex C. This shows that there could be savings to the consumer of 4p-5p/litre of oil. In addition there would be environmental benefits of greater recycling of waste oil, as well as avoiding environmental damage from lower amounts of waste oil being mismanaged. It would also help ensure the UK complied with the European Waste Oil Directive, avoiding further infraction proceedings.

101. The approach would be to seek voluntary agreement with the producers. Only if this appears likely to fail would the possibility of statutory approaches be considered at a later stage.

Option L: Targeted action on illegal waste management

102. The consultation document asks whether existing powers should be extended for use by a wider range of authorities and proposes that more resources be targeted at waste crime prevention and greater enforcement action.

103. The benefits of further action could include:
a. reduce levels of fly-tipping

- b. deal with some long-standing problem areas where there is no occupier
- c. reduce harm to health and wildlife
- d. add to amenity and liveability of area
- e. better cost recovery for the enforcing authorities
- f. stronger deterrents
- g. reduce competition from illegal operators.

104. The costs will include:

- a. costs to culpable organizations and individual of clearing waste
- b. cost of enforcement to authorities concerned to the extent that they cannot be recovered
- c. costs to legally operating organizations increased to fund enforcement.

105. It is not possible to quantify these costs and benefits at this stage. Any further regulatory proposals or increases in the use of existing powers would only be considered later after further assessment of the costs and benefits.

Other Impacts and Equality and Fairness

106. The individual proposals set out in the consultation document will have a range of social, environmental and economic impacts. The most significant of these have been discussed above. Other impacts are considered in the policy web in Annex D. This has been derived using the Defra policy tool “stretching the web”¹⁴. This shows the impact of the proposals as broadly positive in aggregate, although costs to central Government will increase over the base case through increased support to local authorities and programmes to improve resource efficiency and reduce waste from business and industry. However, it should be borne in mind that costs will rise significantly under the base case, particularly for local authorities in achieving higher rates of recycling and recovery of biodegradable waste in order to meet the requirements of the Landfill Directive (Annex A). Costs to industry will also rise under the base case, but these increases may be mitigated by increased efforts on waste minimisation, recycling and avoided landfill disposal (Annex B).

Equality and Fairness

107. The proposals set out in the waste strategy review are expected to be broadly neutral in terms of equality and issues of fairness (including race, gender, rural communities, low income groups). This is illustrated in the policy web, Annex D. However, as detailed proposals are developed and implementation plans considered it will be important for service deliverers to consider the particular effects on different groups. For instance, as local authorities expand kerbside recycling services to increase recycling, they will need to consider how these are delivered in rural areas, in high rise flats, to disabled people, etc¹⁵.

¹⁴ <http://intranet/sustainable/thinksustainable/forpolicymakers/web/web.asp>

¹⁵ with respect to these, the Household Waste Recycling Act 2003 requires that by 2010 all householders are provided with collection facilities for at least two materials, which sets a minimum floor for service provision. Also rural funding for recycling is a consideration within the existing Revenue Support Grant to local authorities.

Health Impacts

108. Health impacts of waste management have been considered in the accompanying *Environmental Report* (Section 4) and its *Baseline Review* (Appendix A).

109. The evidence is that waste management has at most a minor effect on human health, particularly when compared with other health risks associated with day to day living¹⁶. The proposals in the consultation document should not materially effect that conclusion. However, local impacts need to be considered in the planning and implementation of local strategies.

Small Firms Impact Test (SFIT)

110. The advice of the DTI's Small Business Service was sought in order to consider the impacts of each option on small firms. During the Stage 1 of SFIT we carried out sounding exercises with small businesses and representative bodies such as the CBI and the Federation of Small Businesses. Representatives of those organisations took part in our general Stakeholder Workshops. We also ran a workshop specifically looking at the position of small businesses. Defra also requested a mailing list from the Small Business Service to enable SMEs to provide comments during the formal consultation.

111. As indicated above, many of the proposals will have a direct or indirect impact on businesses in general including small businesses. Some of options are intended to assist small businesses in particular or will have the effect of helping them or reducing regulatory burdens on them. These include:

- a. **Option B: Simplifying the exemption system;**
- b. **Option C: Waste Prevention initiatives** which seek to find ways to help small businesses improve their resource efficiency;
- c. **Option H: Over-arching Procurement Strategy for municipal waste** which may help smaller firms compete in the market;
- d. **Option I: Wider role for local authorities in non-municipal waste** which will seek to improve availability of recycling services for small businesses in particular;
- e. **Option L: Targeted action on illegal waste management** should include help to small businesses to ensure their waste is dealt with properly and legally.

112. As we develop the strategy, and specific proposals within it, we will undertake more in-depth consultations concurrently with the formal consultation (as part of Stage 2 of SFIT).

¹⁶ *Review of the environmental and health effects of waste management* (2004)
<http://www.defra.gov.uk/environment/waste/research/health/index.htm>

Competition assessment

113. The waste management industry is the market that is most directly affected. However, all businesses will be affected to some degree. The waste management industry is relatively concentrated, and is becoming more so.

114. The market is not expected to be significantly affected by the options being considered. Option H (Over-arching procurement strategy) will have some effect on the operation of the waste management industry with a view to achieving a more effective and competitive market for municipal waste contracts.

115. For these reasons, having appraised the options using the competition filter, the view is that there is no need for a detailed competition assessment (see filter assessment at Annex E).

Enforcement, sanctions and monitoring

116. The consultation document proposes that an inter-departmental Sustainable Waste Programme Board be established to drive delivery of the strategy and monitor and review progress.

117. The consultation document includes proposals to prevent waste crime and strengthen enforcement.

Annex A - Municipal waste

Option A: Municipal waste base case, “No policy change”

1. Article 5 of EU Directive 1999/31/EC on the landfill of waste (the Landfill Directive) sets legally binding commitments to reduce biodegradable municipal waste (BMW) to landfill by 2010, 2013 and 2020.
2. *Waste Strategy 2000* set national targets for the recycling/composting of household waste to 2015 and provided the framework for the introduction of statutory performance standards for local authorities for 2003/04 and 2005/06. These are acting as major drivers in the management of the estimated 29 million tonnes of MSW generated per annum.
3. Progress with respect to MSW was reviewed in 2002 by the Prime Minister's Strategy Unit. This established the Waste Implementation Programme (WIP) in 2003 to provide additional support to local authorities in achieving the Landfill Directive BMW targets. As announced in the 2002 Pre-Budget Report, following consultation, the standard rate of landfill tax was increased by £3 in 2005-06 to £18 per tonne, and will increase by at least £3 per tonne in the years thereafter, on the way to a medium- to long-term rate of £35 per tonne. The Landfill Allowances Trading Scheme (LATS) was subsequently introduced under the Waste and Emissions Trading (WET) Act 2003 as the main statutory mechanism for achieving these targets. Additionally the Household Waste Recycling Act 2003 requires that by 2010 Waste Collection Authorities (WCAs) provide for the separate collection of at least two types of recyclable waste from households.
4. Consequently, many of the key policy levers are very new and there is a limited evidence base on which to assess their impacts. But the policies and measures introduced since publication of *Waste Strategy 2000* have driven considerable change in local authority waste management, including a substantial increase in the recycling and composting of household waste, and in the development of markets for recovered materials. The interim *Waste Strategy 2000* target for the recycling/composting of 17% of household by 2003/04 has been achieved and good progress is being made towards the 2005/06 target of 25% with recycled in 2004/05 provisionally estimated at over 22%. The Government is currently consulting on short term local authority recycling targets for 2007/8.

Municipal waste data

5. Defra's annual Municipal Waste Survey provides the most comprehensive evidence on the sources, quantities and fates of municipal waste collected by local authorities in England¹⁷. In 2003/04 local authorities collected 29.1 million tonnes of MSW. Of this, 25.4 million tonnes was household waste, the remainder being collected from sources such as industry, commerce, municipal parks and gardens. In total, 28% (8.1 million tonnes) of MSW had some sort of value (recycling, composting, energy recovery) recovered from it and 72% (20.9 million tonnes) was

¹⁷ Municipal waste survey 2003/04, Defra.
<http://www.defra.gov.uk/environment/statistics/wastats/index.htm>

disposed of in landfill. Of the MSW disposed of in landfill an estimated 14.7 million tonnes was biodegradable.

Municipal waste forecasts

6. Defra's municipal waste survey indicates a growth in waste between 1998/99 and 2003/04. Average growth for MSW was 2.0% per annum. Household waste has grown at a slightly lower rate of 1.6% per annum, indicating some decoupling from economic growth. In 2003/04 the amount of MSW and household waste fell slightly for the first time, a reduction of 1.0% and 1.5% respectively on 2002/03.

7. However, past data provides insufficient evidence and understanding of recent trends on which to base future projections. Three growth scenarios for MSW have therefore been developed to assess a range of possible future outcomes to 2020:

- a high case of 2.25% per annum reflecting recent trends in growth of MSW, representing a total growth of 13.5 million tonnes by 2020 (47% increase);
- a central case of 1.5% per annum in line with current household waste growth, representing a total growth of 10.2 million tonnes by 2020 (35% increase); and
- a low case of 0.75% per annum, representing a total growth of 5.6 million tonnes by 2020 (20% increase).

Assessment of base case scenarios

8. The three growth scenarios have been assessed using Defra's LAWRRD model, Annex I. This is a national model which works at Waste Disposal Authority (WDA) level to predict future facility requirements in response to different policy drivers, including local authority standards, landfill allowances trading and landfill tax pressures.

9. Baseline projections are set out in Table A1. These assume the Government's preferred option for local authority standards for 2007/8 outlined in the recent consultation paper *Options for Local Authority Statutory Performance Standards on Recycling and Composting in 2007/8*. This is to maintain the 2005/06 standards in 2007/8 whilst raising the minimum recycling floor to 20% (from 18%). It also assumes the landfill tax escalator is maintained at £3 per tonne to reach £35 per tonne in the medium term.

10. The projections indicate that household recycling/composting rates will need to increase to between 36% and 40% in 2009/10 whilst, *at the same time*, energy recovery (including both energy from waste incineration and refuse derived fuels from MBT processes) needs to increase to around 15%. Overall, this represents a need for between 170 and 220 new facilities by 2009/10¹⁸. The results are driven by the economic pressure to avoid landfill allowances penalties (£150 per tonne) and market constraints in the delivery of major treatment facilities.

¹⁸ Including between 70 and 90 materials reclamation facilities (MRF) and 55 to 65 additional green waste composting (windrow composting) facilities

Table A1: Baseline projection of MSW requirements with waste growth

	2005/06	2009/10	2012/13	2019/20
Landfill Allowances (kt)	15,196	11,200	7,460	5,220
Waste Growth = 2.25%				
MSW Arisings (kt)	30,330	33,210	35,550	41,620
BMW to landfill (kt)	13,770	11,090	7,290	5,290
Household recycling / composting (kt)	6,520 (25%)	11,670 (40%)	15,230 (48%)	21,330 (58%)
Energy recovery	3,450 (12%)	5,020 (16%)	7,910 (23%)	9,600 (24%)
Number of new facilities (additional to facilities in 2003/04)	78	220	328	540
Waste Growth = 1.5%				
MSW Arisings (kt)	29,890	31,780	33,270	37,000
BMW to landfill (kt)	13,520	11,180	7,500	5,440
Household recycling / composting (kt)	6,450 (25%)	10,840 (39%)	14,300 (49%)	18,730 (57%)
Energy recovery	3,440 (12%)	4,530 (15%)	6,780 (21%)	8,280 (23%)
Number of new facilities (additional to facilities in 2003/04)	77	182	273	442
Waste Growth = 0.75%				
MSW Arisings (kt)	29,450	30,400	31,120	32,860
BMW to landfill (kt)	13,330	10,920	7,540	5,380
Household recycling / composting (kt)	6,300 (25%)	9,820 (37%)	12,530 (46%)	15,850 (54%)
Energy recovery	3,430 (12%)	4,460 (15%)	6,280 (21%)	7,420 (23%)
Number of new facilities (additional to facilities in 2003/04)	73	168	237	331

11. The projections further indicate that household recycling levels will need to rise to over 45% if the 2012/13 target is to be met. In the long term recycling/composting rates of over 50% will be required with energy recovery increasing to up to 25% depending on growth rates. This is comparable with the best of current European performance and represents a need for between 330 and 540 new facilities compared to the 2003/04 baseline¹⁹.

12. International evidence suggests that such levels of recycling have not been achieved in the absence of a supporting pricing framework on the individual. Defra has initiated a £5 million programme of local household pilot incentives schemes to encourage householder participation in recycling. In light of the results of these pilots, Government intends to consider the scope and desirability for additional pricing mechanisms, including householder charging, to support the levels of recycling anticipated to be required.

13. The projections in Table A1 take into account existing and proposed waste management infrastructure identified through local authority surveys and assessment of current PFI applications. In the base case it is assumed that all facilities become available on their planned timescales. However, experience suggests that proposals are often delayed within the planning or implementation process. The impact of such delays on the achievement of the Landfill Directive targets is indicated in Table A2. This assumes that proposed facilities are delayed by one year, with any shortfall being made up as far as practicable by increased recycling, composting, energy recovery and stabilisation.

14. Table A2 indicates that if all the planned facilities were delayed by one year (Option A1), the 2009/10 Landfill Directive target could still be met though increased levels of recycling and additional MBT facilities producing refuse derived fuels (RDF). If however the measures identified in Option G do not deliver demand for RDF, the 2009/10 Landfill Directive targets could be exceeded (Option A2) despite authorities

¹⁹ At an estimated capital cost of between £5.3bn and £7.4bn (current prices), based on the capital costs in Annex I (Table I1)

bringing forward alternative additional recycling and composting facilities to achieve recycling levels observed in Option A. The impact would be greater if waste growth rates were higher than the 1.5% per annum considered in Table A2.

Table A2: Impact of facility delays (1.5% growth rate)

	2005/06	2009/10	2012/13	2019/20
Landfill Allowances (kt)	15,196	11,200	7,460	5,220
MSW Arisings (kt)	29,890	31,780	33,270	37,000
Option A - No Policy Change				
BMW to landfill (kt)	13,520	11,180	7,500	5,440
Household recycling / composting (kt)	6,450 (25%)	10,840 (39%)	14,300 (49%)	18,730 (57%)
Energy recovery	3,440 (12%)	4,530 (15%)	6,780 (21%)	8,280 (23%)
Number of new facilities (additional to facilities in 2003/04)	77	182	273	442
Option A.1 - No Policy Change & Proposed Facilities Delayed by 1 Year				
BMW to landfill (kt)	13,520	11,020	7,320	4,910
Household recycling / composting (kt)	6,450 (25%)	11,150 (40%)	14,610 (50%)	18,170 (55%)
Energy recovery	3,440 (12%)	4,260 (14%)	6,510 (20%)	8,980 (25%)
Number of new facilities (additional to facilities in 2003/04)	77	193	298	439
Option A.2 - No Policy Change, Proposed Facilities Delayed by 1 Year & No Impact from Policies to Increase EfW*				
BMW to landfill (kt)	13,520	11,530	7,230	4,990
Household recycling / composting (kt)	6,450 (25%)	10,900 (39%)	14,830 (50%)	18,250 (55%)
Energy recovery	3,440 (12%)	3,930 (13%)	6,170 (19%)	8,560 (24%)
Number of new facilities (additional to facilities in 2003/04)	77	203	317	445

* See Option G -The Chancellor's 2005 pre-budget report announced Government's intention to develop options for an enhanced capital allowance scheme to encourage investment in markets for the outputs of new waste treatment facilities, including RDF. Government has started work to identify potential end users of RDF and to quantify potential demand for it.

15. The risk of not achieving the projected recycling/composting and energy recovery rates is that adequate allowances may not be available to trade in the key target years of 2009/10, 2012/13 and 2019/20. Individual authorities would then incur a penalty of £150 per tonne BMW by which their allowances were exceeded²⁰. The risk for England is that if the UK as a whole does not achieve the Landfill Directive targets in these key years then the UK will face infraction proceedings and may become liable to daily fines from the European Commission²¹.

Costs and benefits

Costs

16. LAWRRD is an economic model that provides an estimate of the local authority waste management costs based on the collection systems employed and gate fees associated with the range of treatment technologies considered (Annex I).

17. The costs for the base case 1.5% growth scenario in Table A1 are summarised in Table A3. These are expressed as actual prices and net of (all) landfill tax, and discounted to 2003/04 prices at 3.5% per annum in accordance with Treasury Green Book guidance.

18. LAWRRD indicates net discounted costs rising from £1.8bn in 2005/06 to £3.0bn in 2019/20, reflecting the progressive requirements of the Landfill Directive for diverting BMW from landfill and the continuing growth in waste arisings. The total

²⁰ Progress towards these targets therefore requires ongoing monitoring, as there is uncertainty both in the rate of waste growth and in the timely delivery of the required infrastructure

²¹ These fines may be €0.5 million per day

discounted cost for the period 2003/04 to 2019/20 is estimated at £42.4bn²². This is the base case against which other options are considered.

Table A3: Predicated base case MSW management costs

	2005/06	2009/10	2012/13	2019/20	Total
Actual Prices (£m)	£2,310	£3,430	£4,150	£5,190	£62,860
Actual prices net of LF tax (£m)	£1,960	£2,970	£3,780	£4,920	£56,750
2003/4 prices net of LF tax (£m)	£1,890	£2,590	£3,070	£3,350	£45,640
Discounted net of LF tax (£m)	£1,820	£2,420	£2,830	£3,040	£42,360

Benefits

19. The principal benefits of the proposals set out in the consultation document accrue to the environment, either through reductions in landfilling and attendant landfill gas emissions or through greater resource efficiency within product life cycles. A life cycle approach has therefore been taken to the quantification of benefits. Greenhouse gas emissions are used as a proxy for total environmental impact, and monetised using low, medium and high estimates of the social cost of carbon²³. The methodology is set out in Annex H.

20. The base case estimates of (discounted) environmental benefit are summarised in Table A4. These indicate that benefits increase with increasing diversion from landfill with a total discounted benefit in the range £2bn to £6bn. This is the base case against which other options are considered.

21. The overall monetised environmental benefit range contrasts with the overall waste management cost of £42bn. However, this excludes daily fines which the European Commission may impose for any breach of the Landfill Directive targets²⁴, which is a major driver within current policy.

Table A4: Monetised estimates of base case environmental impacts

	2005/06	2009/10	2012/13	2019/20	Total
Discounted carbon impact - Low (£m)	£20	£70	£130	£240	£1,890
Discounted carbon impact - Medium (£m)	£40	£130	£220	£400	£3,240
Discounted carbon impact - High (£m)	£70	£250	£410	£720	£5,940
Total carbon impact (tonnes of CO2)	-1,840,000	-6,194,000	-10,111,000	-17,100,000	-143,647,000

²² And a capital investment of £6.2bn at current prices

²³ Low £40/t, medium £78/t and high £153/t carbon

²⁴ €0.5 million per day from 2010

Annex B – Commercial, Industrial & Hazardous waste

Option A: CI&H waste base case, “No policy change”

1. The waste management landscape in England for CI&H wastes has evolved considerably since the publication of *Waste Strategy 2000*, particularly in response to the progressive implementation of the Landfill Directive, the Pollution Prevention and Control Regulations 2000, the Hazardous Waste Regulations 2005, and various Producer Responsibility Directives such as on packaging and packaging wastes, end of life vehicle, and waste electrical and electronic equipment. The Business as usual case of ‘no policy change’ therefore implies a continuing and complex evolution of the waste management landscape.

2. There is no robust evidence base on which to construct the “Business as usual” case. This reflects both a general paucity of waste-related data for these waste streams and the fact that many of the policy drivers are new (such as the landfill tax escalator) or, as in the case of landfill re-permitting, have yet to be implemented. One of the major objectives of current programmes is to construct a more robust evidence base on which to build future policies. This includes both the Defra waste R&D strategy and the waste data strategy.

3. The Environment Agency’s 2002/03 Commercial & Industrial waste survey provides the most comprehensive and current evidence on the sources, quantities and fates of CI&H wastes in England. In addition, the Environment Agency’s Special Waste Tracking System (SWaT) database provides time series information on hazardous wastes movements, although not disaggregated waste type (i.e. solid, liquid, sludges etc). The two datasets are not entirely consistent, therefore, unless otherwise stated, all CI&H data is derived from the 2002/03 survey.

4. The total CI&H waste stream is estimated at 67.5 million tonnes, comprising 39.3 million tonnes from industrial sources and 28.2 million tonnes from commercial sources. Summary totals and percentages classified by national waste group are given in Table B1 and Table B2²⁵. These indicate that 42% of total arisings are recycled or re-used, a further 8% recovered or otherwise treated. Treatment and recovery have therefore overtaken landfill as the dominant method of CI&H waste management.

The Environment Agency survey indicates that 6.7 million tonnes (10%) of CI&H wastes are transferred, treated or managed by methods not recorded. For reporting purposes, this tonnage is generally re-allocated proportionately between the other categories shown²⁶. On this basis, 44% of waste is assumed to be landfilled and

²⁵ These tonnages differ slightly from those published on the Agency website due to small differences in allocations between waste streams.

²⁶ This convention is used both in Environment Agency reporting and in the waste strategy review consultation document

Table B1: CI&H waste arisings 2002/03, from EA waste survey (kt)

	Landfill	Land Spread	Recycled	Re-used	Thermal	Transfer	Treatment	Unknown	Totals
Construction & demolition	1,335	4	250	117	-	23	-	43	1772
Combustion wastes	4,163	-	4,048	1,489	3	3	8	33	9747
Common sludges	188	381	96	120	12	20	83	177	1077
Discarded equipment	76	-	170	36	1	10	1	25	319
Food wastes	555	1,005	978	890	586	185	339	1,071	5,609
Industrial sludges	417	414	163	236	5	12	339	9	1,595
Metallic wastes	167	-	2,758	134	-	69	5	109	3,242
Oils & solvents	68	3	227	39	97	66	191	81	772
Chemical wastes	1,168	398	483	548	524	80	325	170	3,696
Mineral wastes	1,594	6	240	643	-	9	10	31	2,533
General industrial wastes	4,766	8	242	421	169	274	63	268	6,211
General commercial wastes	11,609	-	431	18	401	943	2	760	14,164
Non-metallic wastes	620	76	3,201	1,270	92	69	-	118	5,446
Organic wastes	3	7	79	10	4	-	9	1	113
Paints, varnishes, etc.	81	5	35	4	10	46	36	5	222
Paper and card	902	15	8,027	40	80	194	-	371	9,629
Sorting residues	726	-	534	1	100	-	-	1	1,362
Totals	28,438	2,322	21,962	6,016	2,084	2,003	1,411	3,273	67,509
	Current treatment route								Totals
Construction & demolition	75%	-	14%	7%	-	1%	-	2%	100%
Combustion wastes	43%	-	42%	15%	-	-	-	-	100%
Common sludges	17%	35%	9%	11%	1%	2%	8%	16%	100%
Discarded equipment	24%	-	53%	11%	-	3%	-	8%	100%
Food wastes	10%	18%	17%	16%	10%	3%	6%	19%	100%
Industrial sludges	26%	26%	10%	15%	-	-	21%	-	100%
Metallic wastes	5%	-	85%	4%	-	2%	-	3%	100%
Oils & solvents	9%	-	29%	5%	13%	9%	25%	10%	100%
Chemical wastes	32%	11%	13%	15%	14%	2%	9%	5%	100%
Mineral wastes	63%	-	9%	25%	-	-	-	1%	100%
General industrial wastes	77%	-	4%	7%	3%	4%	1%	4%	100%
General commercial wastes	82%	-	3%	-	3%	7%	-	5%	100%
Non-metallic wastes	11%	1%	59%	23%	2%	1%	-	2%	100%
Organic wastes	3%	6%	70%	9%	4%	-	8%	-	100%
Paints, varnishes, etc.	36%	2%	16%	2%	5%	21%	16%	2%	100%
Paper and card	9%	-	83%	-	-	2%	-	4%	100%
Sorting residues	53%	-	39%	-	7%	-	-	-	100%
Average	42%	3%	33%	9%	3%	3%	2%	5%	100%

Table B2: CI&H waste arisings 2002/03 by type, from EA survey (kt)

	Landfill	Land Spread	Recycled	Re-used	Thermal	Transfer	Treatment	Unknown	Totals
Non-Hazardous Solid	25,715	619	20,028	5,032	1,226	1,704	232	2,985	57,541
Non-Hazardous Sludge	161	145	309	59	244	123	421	87	1,549
Non-Hazardous Mixed	40	4	14	12	119	4	8	40	241
Non-Hazardous Liquid	108	31	38	-	3	4	39	5	228
Hazardous Solid	745	-	288	60	389	17	57	40	1,596
Hazardous Sludge	263	981	673	399	25	63	478	38	2,920
Hazardous Mixed	969	3	108	50	67	59	47	3	1,306
Hazardous Liquid	437	539	504	404	11	29	129	75	2,128
Totals	28,438	2,322	21,962	6,016	2,084	2,003	1,411	3,273	67,509

51% recovered. For this pRIA the more conservative assumption is made of allocating the land spread, transferred and 'managed by methods not recorded' categories to landfill. On this basis, 53% of CI&H waste is deemed to be landfilled.

5. The data includes an estimated 3.6 million tonnes of hazardous waste, of which 1.56 million tonnes is landfilled (Table B2). This includes 520 kt of hazardous liquid wastes. These wastes were banned from landfill post the survey in 2002 and are therefore excluded from this analysis.

6. In addition, some 9 million tonnes of construction, demolition and excavation wastes (CDEW) are disposed of as waste to licensed landfill²⁷.

CI&H waste forecasts

7. Baseline projections indicate CI&H waste arisings increasing from 67.5 million tonnes in 2002/03 to roughly 86.3 million tonnes in 2019/20. These projections are based on a sectoral growth model of the UK economy which integrates a degree of decoupling between economic growth and waste growth based on the difference between modelled and empirical evidence from the 1998/99 and 2002/03 Environment Agency waste surveys²⁸.

8. The historic decoupling cannot be ascribed to particular factors, although Government funded programmes such as Envirowise will have contributed. Specific economic and regulatory measures have since been introduced that will drive further decoupling, and must be considered within the Business as usual case:

Environment Agency targets on PPC regulated industries

9. The PPC regime places a statutory obligation on regulated industries to reduce waste. The Environment Agency has set a reduction target of 15% on these industries for the period 2002-07²⁹, which covers some 11.5 million tonnes of waste (approximately 30% of all industrial waste). Current indications are that this target will be met. It is estimated that these wastes will reduce by 1.73 million tonnes per annum by 2007, representing a cumulative diversion of 5.2 million tonnes between 2002 and 2007.

Chemical sector voluntary reduction target

10. The chemical industry is a major producer of hazardous wastes. The Chemical Industries' Association (CIA) as part of its "Responsible Care" programme has established a goal of reducing hazardous waste per tonne of production by its members by 25% between 2000 and 2010. Based on sector growth projections, this represents a reduction of 122,000 tonnes per annum of hazardous wastes by 2010.

²⁷ Some 90 million tonnes of construction, demolition and excavation wastes are generated annually, but mostly recycled or used in quarry and landfill restorations.

²⁸ Cambridge Econometrics REEIO model, Annex J

²⁹ Environment Agency's corporate strategy *Making it Happen 1*

Impact of landfill tax

11. Current policy is to maintain the landfill tax escalator at £3 per tonne to reach £35 per tonne for active wastes in the medium term. The escalator is anticipated to provide a significant stimulus for further diverting waste from landfill. Using the HM Customs and Excise landfill tax model³⁰, the central estimate of this diversion is 2.71 million tonnes in 2011 (at £35/t) and rising with waste growth to 3.13 million tonnes in 2020. This represents a cumulative diversion of 33.5 million tonnes between 2006 and 2020.

12. As a result of these further decoupling measures, total CI&H waste in 2020 is projected to be around 84.5 million tonnes, with the share of industrial waste falling from 58% in 2002/03 to 47% in 2019/20 (Table B3). Projections further indicate an average annual growth in commercial wastes of 2.6% and essentially zero industrial waste growth, reflecting the decoupling measures aimed at industrial waste and the expected continued shift towards a service based economy.

Table B3: Estimated CI&H waste arisings 2002-2020 (kt/y)

Waste arisings 2002-20 (kt/y)	2002/03	2004/05	2009/10	2014/15	2019/20
Construction & demolition	1,770	1,770	1,630	1,540	1,460
Combustion wastes	9,750	9,760	9,490	9,370	9,240
Common sludges	1,080	1,040	1,030	1,080	1,120
Discarded equipment	320	350	370	430	490
Food wastes	5,610	5,450	5,420	5,720	6,170
Industrial sludges	1,600	1,570	1,570	1,650	1,730
Metallic wastes	3,240	3,290	3,500	3,760	4,040
Oils & solvents	770	820	920	1,060	1,230
Chemical wastes	3,700	3,810	4,010	4,310	4,680
Mineral wastes	2,530	2,510	2,370	2,270	2,160
General industrial wastes	6,210	6,030	6,000	6,120	6,260
General commercial wastes	14,160	14,370	15,010	16,780	19,040
Non-metallic wastes	5,450	5,600	6,090	7,040	8,250
Organic wastes	110	110	100	90	90
Paints, varnishes, etc.	220	240	250	270	290
Paper and card	9,630	10,080	11,500	13,790	16,710
Sorting residues	1,360	1,310	1,340	1,430	1,510
Totals	67,510	68,110	70,600	76,710	84,470
% Industrial waste	58%	57%	55%	51%	47%

Landfill Directive requirements

13. It is also relevant to consider the impact of the Landfill Directive in the base case. The Directive introduces progressive restrictions on the landfilling of biodegradable municipal waste and bans the landfill disposal of prescribed wastes, including:

- a. liquid wastes, both hazardous and non-hazardous;
- b. wastes that exhibit explosive, oxidising, highly flammable, flammable or corrosive properties;

³⁰ HMCE model, Annex J

- c. hospital and other clinical wastes arising from medical or veterinary establishments that are infectious;
- d. tyres, whole or shredded;
- e. untreated waste, unless the waste is inert where treatment is not feasible or is a waste for which treatment will not reduce the quantity of waste or the hazards to human health or the environment;
- f. any other waste that does not fulfil the acceptance criteria determined in accordance with the Directive.

14. The ban on landfilling hazardous liquids was imposed in 2002. The other restrictions are required to be in place by July 2007³¹.

15. Waste acceptance criteria have been established for wastes consigned to inert and hazardous waste landfills. There are currently no proposals to introduce acceptance criteria for non-hazardous wastes, other than the Article 6 requirement for 'treatment' prior to landfill. Treatment is defined as *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.*

Assessment of base case scenario

16. This base case assumes no further changes in the drivers of waste growth or treatment method beyond those above. However, in order to evaluate the base case it is necessary to quantify the future Article 6 'treatment' requirements. This has been done for each waste category (hazardous solids, non-hazardous mixed wastes, etc) based on knowledge of the current treatment of CI&H wastes treatment derived from the Environment Agency C&I survey 2002/03 (as summarised in Table B1) and judgement as to the proportions of additional waste that may require treatment by different methods.

17. For each category of material an assessment of future treatment methods is provided by treatment route and material type. An example is given Table B4 for non-hazardous solid wastes for 2007/8³². Allocating tonnages of materials to treatment types allows the comparison of costs and benefits from the base case to the new policy case. Assuming a certain plant capacity it is also possible to assess the potential infrastructure needs of different scenarios.

18. The comparable analyses for hazardous solid wastes and the aggregate analysis for sludges, mixed wastes and non-hazardous liquid wastes are set out in Table B5 and Table B6 respectively.

19. Table B7 summarises the resultant aggregate base case waste flows and facility requirements. This is an aggregate total for all waste streams excluding hazardous liquid wastes (which are assumed to be fully treated at present as a result of being banned from landfill in 2002), and provides the base case against which other options are compared.

³¹ Although by voluntary agreement the ban on tyres has been brought forward to July 2006

³² Which aggregates the commercial and the industrial components

Table B4: Base case allocation of non-hazardous solid wastes to treatment routes (2007/08)

	Arisings landfilled requiring treatment, kt/y	Waste Minimisation	In House Re-use	Merchant Recycling	Simple Sorting	Complex Sorting / Treatment	Composting	Anaerobic	Solidification	Combustion	No Treatment (landfill)	Waste to landfill (including treatment residues), kt/y
Construction & demolition	1,261	7%									93%	1,170
Combustion wastes	3,765			10%							90%	3,450
Common sludges	241										100%	240
Discarded equipment	103			83%							17%	30
Food	1,804	20%					13%			6%	62%	1,280
Industrial sludges	260		20%								80%	210
Metallic wastes	288		4%	96%								40
Oils & solvents	-											-
Chemical wastes	1,285	10%	15%			25%			15%	25%	11%	650
Mineral wastes	1,307		29%	20%	29%						22%	650
General industrial wastes	4,759	10%	10%	15%	15%						50%	3,090
General commercial wastes	12,622	10%		15%	15%					10%	50%	8,520
Non-metallic wastes	762		21%	71%						3%	5%	130
Organic wastes	5			51%							49%	-
Paints, varnishes, etc.	18			30%		50%					20%	10
Paper and card	1,446	8%	4%	66%						4%	19%	430
Sorting residues	681									10%	90%	630
<i>sub-total kt/y</i>	<i>30,606</i>	<i>2,426</i>	<i>1,329</i>	<i>5,102</i>	<i>2,991</i>	<i>327</i>	<i>231</i>	<i>-</i>	<i>189</i>	<i>1,831</i>		<i>20,530</i>
Additional treatment from existing plant & waste growth kt/y	28,367	778	4,926	21,256	165	18	13		10	1,200		3,660
Totals	58,970	3,200	6,260	26,360	3,160	340	240	-	200	3,030		24,190
% residues to landfill				15%	85%	65%	60%	30%	120%	25%	100%	
Average plant capacity				80	15	50	50	100	50	200	1	
Additional plants required		-	-	80		6	4	-	3	9	-	

Table B5: Base case allocation of hazardous solid wastes to treatment routes (2007/08)

	Arisings landfilled requiring treatment, kt/y	Waste Minimisation	In House Re-use	Merchant Recycling	Simple Sorting	Complex Sorting/Treatment	Composting	Anaerobic	Solidification	Combustion	No Treatment (landfill)	Waste to landfill (including treatment residues), kt/y
Construction & demolition	34					76%					24%	20
Combustion wastes	127		10%	30%					60%		1%	100
Common sludges	-											-
Discarded equipment	17			100%								-
Food	1	10%				30%			30%	30%		-
Industrial sludges	25			10%					40%	50%		20
Metallic wastes	3			22%		78%						-
Oils & solvents	9									100%		-
Chemical wastes	176	10%	11%			17%			11%	39%		60
Mineral wastes	195	10%				31%			20%		40%	150
General industrial wastes	52	10%	10%			15%				15%	50%	30
General commercial wastes	103	20%			30%	40%				10%		50
Non-metallic wastes	9		19%	81%								-
Organic wastes	-											-
Paints, varnishes, etc.	19					30%			30%	40%		10
Paper and card	9	10%	5%	80%						5%		-
Sorting residues	-											-
<i>sub-total kt/y</i>	<i>779</i>	<i>64</i>	<i>40</i>	<i>73</i>	<i>31</i>	<i>173</i>			<i>150</i>	<i>116</i>		<i>440</i>
Additional treatment from existing plant & waste growth kt/y	792	13	61	293	5	27			24	369		197
Totals	1,570	80	100	370	40	200			170	480		640
% residues to landfill				20%	85%	50%	60%	30%	120%	25%	100%	
Average plant capacity				50	15	50	20	10	50	80		
Plants required				10		1		1	2	3		

Table B6: Base case allocation of sludges, mixed wastes and non-hazardous liquid wastes to treatment routes (2007/08)

	Arisings landfilled requiring treatment, kt/y	Waste Minimisation	In House Re-use	Merchant Recycling	Simple Sorting	Complex Sorting/Treatment	Composting	Anaerobic	Solidification	Combustion	No Treatment (landfill)	Waste to landfill (including treatment residues), kt/y
Construction & demolition	1			41%							59%	-
Combustion wastes	76		2%	2%		18%			56%		22%	70
Common sludges	454	10%		0%	0%			41%		7%	41%	250
Discarded equipment	2			100%								-
Food	875	19%	0%	19%			1%	47%		1%	12%	280
Industrial sludges	507	6%		12%				16%	4%		60%	370
Metallic wastes	-											-
Oils & solvents	83			66%						32%	2%	20
Chemical wastes	265	3%	5%	35%		8%		35%	8%	6%		80
Mineral wastes	17	3%				8%			5%		84%	20
General industrial wastes	207	9%	9%	21%	14%					0%	46%	130
General commercial wastes	814	9%				1%		7%		9%	74%	630
Non-metallic wastes	76		1%	50%	2%						47%	50
Organic wastes	3			12%				85%			3%	-
Paints, varnishes, etc.	94								17%	83%		30
Paper and card	68	1%	0%	24%						0%	74%	50
Sorting residues	-											-
<i>sub-total kt/y</i>	<i>3,542</i>	<i>350</i>	<i>40</i>	<i>480</i>	<i>30</i>	<i>40</i>	<i>10</i>	<i>840</i>	<i>100</i>	<i>240</i>		<i>1,980</i>
Additional treatment from existing plant & waste growth kt/y	3,078	67	849	1,269	44	25	9	563	41	206		609
Totals	6,620	420	890	1,750	70	60	20	1,400	140	450		2,590
% residues to landfill				25%	90%	30%	60%	30%	120%	10%	100%	
Average plant capacity				50	15	50	20	100	50	80		
Plants required		-	-	8		1	-	-	2	3	-	

Table B7: Base case projection of waste arisings and facility requirements (aggregated CI&H wastes)

	2002/03	2007/08	2009/10	2014/15	2019/20
Arisings, kt	66,040	67,160	68,860	74,720	82,290
Waste Treatment**, kt					
Minimisation		3,700	4,560	5,790	6,390
Re-use	5,960	7,250	7,280	7,450	7,730
Recycling	21,650	28,480	29,290	32,480	36,870
Thermal	1,840	3,960	3,970	4,180	4,560
Treatment	990	6,050	6,100	6,410	6,880
Landfill	35,520	27,420	27,510	29,020	31,580
Treatment type by percentage of total waste					
Re-use	9%	11%	11%	10%	9%
Recycling	33%	42%	43%	43%	45%
Thermal	3%	6%	6%	6%	6%
Treatment	1%	9%	9%	9%	8%
Landfill***	54%	41%	40%	39%	38%
Additional facilities*		133	145	188	249

* estimated additional to plants in 2002/03

** excludes hazardous liquid wastes

*** includes additional residues landfilled from treatment

20. The results indicate that some 145 additional treatment facilities may be required by 2009/10 compared with 2002/03. These are predominantly merchant recycling facilities, for which an additional capacity requirement of 7.6mt/y is projected to be required, principally for metal scrap and mixed commercial wastes. Some of this capacity may be integrated with local authority recycling facilities for MSW. Similarly, it is indicated that some 2.1mt of additional thermal treatment capacity may be required, including for some hazardous wastes. It is unlikely that significant thermal treatment facilities dedicated to CI&H wastes will be brought forward, but again there may be opportunities to exploit capacity for non-hazardous wastes in municipal facilities and for all CI&H wastes in cement kilns³³.

Costs and benefits

Costs

21. Treatment costs are estimated from data generated as part of the Environment Agency C&I survey. These costs are summarised in Table B8. High and low estimates (£/t) are provided for each treatment option. These have been applied to the waste flow projections in Table B4, Table B5 and Table B6 for each successive year to derive a high and low estimate of the annual treatment costs.

³³ the cement industry is increasingly seeking to use waste-derived substitute fuels such as scrap tyres or substitute liquid fuels, where these cannot be technically and economically recovered or recycled further up the waste hierarchy, and has set targets within its Sector Plan of 10% fuel used to comprise waste materials by 2010 and 15% by 2010 (<http://publications.environment-agency.gov.uk/pdf/GEHO1105BJVI-e-e.pdf>). See also Annex C related to waste oils.

Table B8: Assumed costs for CI&H landfill and treatment (£/t)

Landfill Costs £/t	Hazardous Mixed		Hazardous Sludge		Hazardous Solid		Non-Hazardous Liquid		Non-Hazardous Mixed		Non-Hazardous Sludge		Non-Hazardous Solid	
	45		80		80		35		30		25		30	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Waste Minimisation	0	20	0	20	0	20	0	15	0	10	0	10	0	10
In House Re-use	0	50	-	-	0	50	0	5	0	30	0	25	0	20
Merchant Recycling	30	100	50	100	20	100	50	70	5	30	5	15	5	20
Simple Sorting	-	-	-	-	10	30	-	-	5	10	-	-	0	5
Complex Sorting/Treatment	30	100	-	-	20	80	15	30	5	20	5	15	5	20
Composting	-	-	-	-	5	35	-	-	5	25	5	25	0	25
Anaerobic	-	-	5	55	5	55	5	15	-	-	5	20	10	30
Neutralisation/Precipitation of Metals	-	-	15	40	-	-	-	-	-	-	-	-	-	-
Solidification	50	100	50	100	50	100	-	-	10	25	10	25	10	25
Thermal/Combustion	45	140	150	400	45	140	80	120	30	80	20	80	20	80

22. The overall costs for the base case (no policy change) option are summarised in Table B9. These are expressed as actual prices and net of (all) landfill tax, and discounted to 2003/04 prices at 3.5% per annum in accordance with Treasury Green Book guidance.

23. The analysis indicates net discounted costs of CI&H management (including landfill residue disposal) of between £970m and £1,880m in 2007/08, and total costs to 2019/20 of between £15.9bn and £31.2bn³⁴. However, these values at best can only be regarded as indicative as costs and underlying modelling are based on broad assumptions, and hence are used here merely to provide a base line for comparing other options.

Table B9: Estimated base case CI&H management costs

	Gate fees	2007/08	2009/10	2014/15	2019/20	Total
Actual Prices (£m)	Low	1,780	2,000	2,420	2,830	37,900
	High	2,820	3,120	3,770	4,510	60,010
Actual Prices net of LF tax (£m)	Low	1,120	1,180	1,400	1,720	23,100
	High	2,170	2,290	2,760	3,410	45,220
2003/4 Prices net of LF tax (£m)	Low	1,040	1,040	1,100	1,190	19,370
	High	2,010	2,030	2,150	2,350	37,890
Discounted net of LF tax (£m)	Low	970	910	800	740	15,940
	High	1,880	1,770	1,580	1,450	31,150

Benefits

24. As with MSW, the assumption is made that the principal benefits of policy options accrue to the environment through increased resource efficiency and reductions in emission burdens. The assessment again uses greenhouse gas emissions as a proxy for total environmental impact. The approach is set out in Annex H. This uses a single waste composition to describe CI&H wastes in aggregate, and is therefore the analysis is significantly less robust than in the case of MSW. However, it provides a useful comparator between options.

25. The monetised environmental benefits are summarised in Table B10. This indicates a large carbon saving in 2007/08 (6mt), which reflects the current high rates of commercial and industrial waste re-use and recycling (42% in 2002/03 and a projected 53% in 2007/08, Table B7).

26. The benefits increase marginally with increasing tonnage recycling to 2019/20, with a total discounted benefit estimated in the range £1.4bn to £4.4bn. This compares with discounted waste management costs of the order of £15.9bn to £31.2bn.

³⁴ The Article 6 Landfill Directive pre-treatment requirements are assumed to have full impact in 2007/08. No additional pressures are assumed in the base case, and hence net discounted costs decline in subsequent years as waste growth is lower than GDP, i.e. at a rate lower than the 3.5% Green Book factor used for discounting costs. However, industry is likely to be sensitive to the actual prices, including landfill tax.

Table B10: Monetised estimates of base case environmental impacts

	2007/08	2009/10	2014/15	2019/20	Total
Discounted Total Carbon Impact - Low £m	£74	£80	£89	£96	£1,366
Discounted Total Carbon Impact - Medium £m	£136	£144	£155	£164	£2,380
Discounted Total Carbon Impact - High £m	£260	£271	£288	£302	£4,407
Total Carbon Impact (kt of CO2)	-6,060	-6,398	-6,853	-7,212	-103,391

Annex C - Producer responsibility scheme for waste lubricating oil: assessment of impacts and costs

Background

1. 400,000 tonnes of waste oil is collected in the UK. This represents some 80% of collectable oil, which is one of the highest collection rates in Europe. It is not known where the remaining 20% goes, but some is likely to be burned in small space heaters in garages and other industrial units.
2. Up to 2005, most of the waste oil collected has been processed to a limited degree to make Recovered Fuel Oil (RFO) which was burned roughly ½ and ½ in 7 power stations (as start up fuel) and some 125 road stone coating plants (used to dry roadstone in small quarries). Each sector paid about 9p/litre for the RFO. On this basis the oil collectors collected from garages and industry free of charge.
3. With the application of the Waste Incineration Directive (WID) to these existing plant from 28 December 2005, both these sectors have either chosen not to upgrade plant to meet the WID emissions standards or simply cannot meet WID requirements. Power stations have already scaled back their use of RFO and are converting to Heavy Fuel Oil (HFO). Roadstone plant are expected to switch to virgin fuel oil from the end of the year, and can do so without significant modification to plant, albeit at significantly increased costs.
4. New users of waste oil are available. Steel makers Corus have already begun to take large quantities of RFO for use as a reductant in their plant at Redcar. Corus has stated that they could take all the 400,000 tonnes of RFO in this one plant.
5. At the same time there is evidence from the cement sector that they are gearing their plant to take RFO from 2006.
6. Corus are currently paying for RFO as the alternative fossil fuels are expensive. An economic price is estimated to be about 6p/l. Cement kilns have alternative waste fuels they can use, and are likely to want to receive waste oil for free or at the most pay 2p/l.
7. This makes waste oil collection a much more unstable business. With the value of RFO falling, collectors may be forced to make a charge for waste oil collection, which some fear will increase mismanagement of waste oil - for example greater use of unregulated space heaters (SWOBs). There is also legitimate concern in the industry with relying on one sole end user for waste oil.
8. A PR system for waste oil could bring the collection system on a much more stable footing. It could be used to encourage more regeneration (recycling) of waste oil, and would reduce the risk of mismanagement and even flytipping of waste oil. It would also help to implement the requirement in the Waste Oil Directive and the likely revised Waste Framework Directive for Member States to take necessary

measures to ensure the collection of waste oil and handling in accordance with Article 4 of the present WFD.

How would a PR system work?

9. The system could be based on the system of PR for packaging waste. Original producers of lubricating oil could be allocated a target for the collection of waste oil in proportion to the amount of virgin oil they place on the market. It would be natural for the oil companies to work with or support existing oil collectors in order to achieve their target. Targets could also be added for the recycling of waste oil, which could include export of oil to other MS for recycling. It might also stimulate either the return of waste oil to a refinery for re-processing, or the establishment of a separate re-refinery in the UK (the last one closed in 2000).

10. The scheme could be either voluntary or statutory. A statutory scheme would guarantee maximum participation by producers. There would be costs for monitoring and administering the scheme. For the farm plastics scheme these are estimated to be £80,000 to £90,000 per annum.

11. The table below shows the estimated prices paid for RFO and the impact on collection charges. It is considered that the break even price for RFO is approx 6p/l (or £24m) – ie below this, the collectors have to begin charging for collection (assuming 80% collection rate).

Collection charge	Use of RFO & value	Collection rate
Pre 2005		
Free collection	Power Stations (50%) 9p/litre Roadstone (50%) 9p/l	80% (400kt)
Post 2005 Interim (not WID compliant and not an Option)		
Free collection	Roadstone (50%) 13p/l Steel sector (50%) 6p/l	80%
Option 1: Post 2005 fully WID compliant		
6p/l	Cement kilns (20%) 0p/l Steel sector (80%) 3p/l	60%
Option 2: PR targets for collection		
0p/l	Cement kilns (60%) 0p/l Steel sector (40%) 6p/l	90%
Option 3: PR targets for collection & recycling		
0p/l	Cement kilns (50%) 0p/l Steel sector (40%) 6p/l Regeneration plant (10%) 4p/l	90%

12. The cost of Option 2 to the original oil producers is therefore £13.2m falling on the oil producers (ie the difference between the £24m break even cost for free collection and the £10.8m income from the steel sector in the scheme). It is assumed that cement kilns would not pay anything for waste oil under the scheme.

13. The cost of Option 3 PR scheme involving a target for regeneration would be £11.4m as it is offset by more waste oil being bought by regenerators.

14. It would be open to the oil industry to pass on the costs of both of these options on to the consumer and other users of lubricating oil. In 1999 some 800,000 tonnes of lubricating oil were sold in the UK (with a value of £1.8 billion). The additional cost of Option 2 would add 1p-2p to the price of a litre of oil. It can be seen that this is actually less than the charge being levied of 6p/l for the collection of waste oil under Option 1. So in fact under Options 2 and 3 there would be savings to the consumer of 4p-5p/l, as well as the savings from not having the environmental costs of Option 1.

15. The benefits of Options 2 and 3 are higher and more certain collection rates, lower amounts of waste oil being mismanaged, and greater potential for recycling of waste oil.

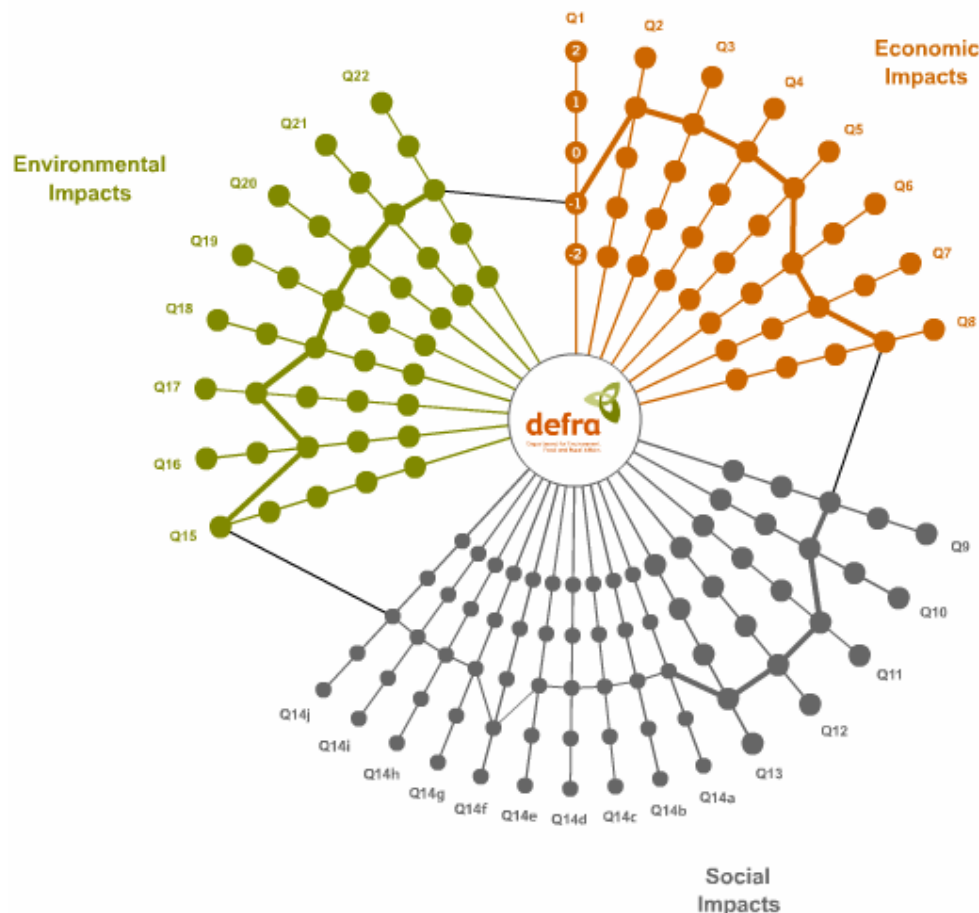
16. The cost of Option 1 is mainly environmental impact: waste oil being mismanaged, being burned in SWOBs and other illegal disposal, caused by a charge having to be levied for collection.

17. Although there are potentially additional costs associated with Option 3 if a regeneration plant were to be set up in the UK – the cost of a plant is estimated to be £25m, investors are likely only to invest in such plant if they can guarantee a return. This is possible under all options where the price of RFO dropped to 3p/l or below. A statutory PR scheme involving targets for the recycling of waste oil presents the strongest signal to investors that there is a market for the regeneration of waste oil in the UK, and a return on their investment. In addition the scheme can work without the need for a plant in the UK, as waste oil can be legally exported for recycling in Germany, where there is a demand for waste oil for regeneration.

Annex D - Policy web

1. The policy web is a tool for illustrating graphically the overall social, environmental and economic impacts of the proposals within the waste strategy review. Brainstorm groups were set up internally to first create a web for the overall policy proposals - generating the policy's 'score' for each question in the pRIA - and then to stretch the web as far as possible by examining the proposals for how they might be adapted to further mitigate negative impacts and increasing positive ones.

2. The decision to create a policy web for the whole waste strategy review - as an aggregate of various policies and not for each individual policy - has been taken in line with guidance from the Cabinet Office on the Sustainable Development Strategy RIA. It is worth noting that we are dealing here with a wide range of policies considered from a strategic perspective, and that options would be assessed in more detail by individual RIAs and subject to their own policy web if they were to be implemented following the consultation process.



3. The questions listed below represent each 'spoke' of the policy web. Negative or positive impacts and neutral impacts resulting from a balancing exercise between negative and positives effects are briefly outlined below.

4. This analysis is again concerned with the impact of the proposals over and above the impact of ongoing changes to the waste management landscape inherent in the base case (no policy change). The balance of some impacts is relatively small compared with these ongoing changes, notably for example in terms of additional investment requirements.

Economic impacts

Q1. Will the proposal result in receipts or savings to the Government? [-1]

A1. Some additional Government (initial or lasting) financial support will be necessary to improve resource efficiency and reduce waste (paragraph 7), to assist businesses to 'design out' waste (paragraph 65) and to support local authorities with an estimated £30m per year across England (paragraph 89).

Q2. Will the proposal affect the costs, quality or availability of goods or services? [+1]

A2. A number of proposals are intended to improve products, recycling and waste management services procurement, and to assist the market for recycled materials (paragraph 7).

Q3. Will the proposal result in new technologies? [+1]

A3. New technology and innovation are expected following clearer indication from the Government of the direction that waste management should take.

Q4. Will the proposal result in a change in the investment behaviour both into the UK and UK firms overseas and into particular industries? [+1]

A4. The waste strategy review delivers a clear message from the Government to the waste management industry regarding the types and scale of investment required. Proposals are included to help local authorities implement existing requirements cost effectively (paragraph 8) and to promote investment by industry in resource efficiency as part of the sustainable consumption and production agenda (paragraph 31).

Q5. Will it impact on the levels of competition within the affected sector? [+1]

A5. Changes due to policies within the current base line are having significant impacts both on waste producers and the waste management industry. However, the market is not expected to be affected significantly by the options being considered (paragraph 113).

Q6. Will the proposal impact on the public sector, including the resources of front-line delivery staff? [0]

A6. Current policies are driving significant change in local authority service provision, particularly with respect to waste collection. The proposals here imply only a marginal increase in additional staff resources and overheads, for example through a wider local authority role with respect to non-municipal waste (see paragraph 92).

Q7. Will the proposal impact on business, charities and voluntary organisations? This could be in the form of a change in prices, outputs, levels of employment or competitiveness? [0]

A7. Costs of waste management are increasing due to pressure within the current base line. The proposals are aimed at inducing cost savings through increased resource efficiency whilst at the same time reducing regulatory burdens on business (paragraph 6). Voluntary and community organisations will be impacted in their capacity as waste producers, but are anticipated to have a greater role as providers of services and in engaging communities in changing behaviour.

Q8. Will the proposal impact on consumers? [+1]

A8. The proposals imply behaviour change both in procurement and in the disposal of residual wastes. This should result in some mitigation of the cost increases implicit in the base case.

Social impacts

Q9. Will the proposal influence health-related behaviour or affect demand for health services? [0]

A9. The rationale for Government policy includes reducing the health impacts of waste. Proposals include taking a more risk-based approach to the exemption and licensing of waste management activities (paragraph 30) and options for the better collection of household hazardous wastes (Option J). Whilst the evidence is that impacts on health are small (paragraph 108), there may be local impacts of additional waste management facilities, and these will need to be considered within local plans and strategies.

Q10. Will the proposal influence safety at work or affect the likelihood of accidents in the community? [0]

A10. There are concerns over accident rates associated with waste management, and particularly with kerbside collection operatives. Major programmes are already in place to improve operator training and certification. No additional proposals are being brought forward at this time.

Q11. Will the proposal affect the rate of crime or crime prevention or create a new offence/opportunity for crime? [+1]

A11. As waste management costs increase flytipping and other waste crimes increase. The waste strategy review therefore proposes more targeted action to prevent waste crime and strengthen enforcement (Option L).

Q12. Will the proposal affect the levels of skills and education? [+1]

A12. The waste strategy review proposes additional waste management and skills training at all level, including schools education, to raise waste awareness and affect behaviour change.

Q13. Will the proposal affect the provision of facilities or services that support community cohesion or in other ways that affect the quality of life in the local community? [+1]

A13. Local environmental quality will improve as a result of action on flytipping and increased environmental awareness.

Q14. *Could the proposal result in any changes in or a differential impact on any of the following?:*

- a. Race equality [0]
- b. Rural communities [0]
- c. Human rights [0]
- d. Gender equality [0]
- e. Disabled people [0]
- f. Children and young people [+1] - Educational impact of learning about recycling, reuse and general environmental awareness through schools programmes
- g. Older people [0]
- h. Income groups [0]
- i. Devolved countries [0] - Separate arrangements apply to other parts of the UK³⁵
- j. Particular regions of the UK [0]

Environmental impacts

Q15. *Will the policy option lead to a change in the emission of greenhouse gases? [+2]*

A15. Greenhouse gas emissions constitute the main global environmental impact of waste management (Annex H). The proposals in the waste strategy review are designed to further mitigate these impacts through measures on waste prevention and increased resource efficiency, and reduced impacts through product life cycles, in line with policies towards sustainable development.

Q16. *Will the policy option be vulnerable to the predicted effects of climate change? [0]*

A16. No. The proposals are intended to assist progress towards climate change targets.

Q17. *Will the policy option lead to a change in the financial costs or the environmental and health impacts of waste management? [+1]*

A17. See above. The proposals are intended to deliver overall benefits relative to the current base case.

Q18. *Will the policy option impact significantly on air quality? [0]*

A18. The proposals do not impose additional air quality impacts relative to the current base case. However, local impacts will need to be considered with respect to individual waste treatment facilities.

Q19. *Will the policy option involve any material change to the appearance of the landscape or townscape? [0]*

³⁵ *Wise About Waste: The National Waste Strategy for Wales*, Welsh Assembly Government, June 2002 (<http://www.wales.gov.uk/subienvironment/content/wstetext-e.pdf>); - *Towards Resource Management: A Consultation on Proposals for a New Waste Management Strategy*, Environment & Heritage Service - Northern Ireland, October 2005 (http://www.ehsni.gov.uk/environment/wasteManage/waste_management.shtml); - *The National Waste Plan*, SEPA, 2003 (<http://www.sepa.org.uk/nws/>)

A19. Increased collection facilities, including kerbside collection containers and bring banks, and major waste management facilities may have a visual impact which needs to be considered at the local planning stage (see Environmental Report).

Q20. Will the proposal change the degree of water pollution, levels of abstraction of water, or exposure to flood risk? [0]

A20. No (see Environmental Report).

Q21. Will the policy option disturb or enhance habitat or wildlife? [0]

A21. No. However, local impacts will need to be considered with respect to individual waste treatment facilities (see Environmental Report).

Q22. Will the policy option affect the number of people exposed to noise or the levels to which they're exposed? [0]

A22. No. However, local impacts will need to be considered with respect to individual waste treatment facilities (see Environmental Report).

Annex E - Competition test

Competition filter test questions

Question	Answer Yes/No
Q1: In the market(s) affected by the new regulation, does any firm have more than 10% market share?	Yes
Q2: In the market(s) affected by the new regulation, does any firm have more than 20% market share?	No
Q3: In the market(s) affected by the new regulation, do the largest three firms together have at least 50% market share?	No
Q4: Would the costs of the regulation affect some firms substantially more than others?	No
Q5: Is the regulation likely to affect the market structure, changing the number or size of firms?	Limited
Q6: Would the regulation lead to higher set-up costs for new or potential firms that existing firms do not have to meet?	No
Q7: Would the regulation lead to higher ongoing costs for new or potential firms that existing firms do not have to meet?	No
Q8: Is the sector characterised by rapid technological change?	No
Q9: Would the regulation restrict the ability of firms to choose the price, quality, range or location of their products?	No

¹ Only to a limited degree relative to the major changes implicit in the base line. Simplification of the regulatory framework and clearer indication of policy direction and targets should increase market confidence, attracting new waste and resource management companies into the field.

Annex F - Existing or forthcoming RIAs considered in waste strategy review

Table F1: Summary of existing or forthcoming waste-related RIAs

Themes	Regulatory instruments subjected to costs and benefits assessments	Status
Waste Framework	Environmental Protection Act 1990	Current
	Control of Pollution Act 1989	Current
	Waste Management Licensing 2005	Current - Final RIA
	Controlled Waste Regulations 1991	Current
	Agricultural Waste Regulations 2005	Proposed - Partial RIA
	Review of Waste Permitting 2004	Proposed - Initial RIA
Landfill	Waste and Emissions Trading Act 2003	Current - Final RIA
	LATS 2004	Current - Final RIA
	Landfill Regulations 2005	Under revision - Partial RIA
	Landfill Tax Regulations 2004	Current
	Aggregate Levy Regulations 2002	Current - Final RIA
	Implementation of Landfill Directive 2001	Current - Final RIA
Hazardous Waste	Controlled Waste Regulations 1993	Current
	Hazardous Waste Regulations 2005	Current - Final RIA
Incineration of Waste	PPC Regulations 2000	Current - Final RIA
	Waste Incineration Regulations 2002	Current - Final RIA
ELV	ELV Regulations 2005	Current - Final RIA
Waste Oil	Oil Storage Regulations 2001	Current - Final RIA
Disposal of PCBs & PCTs	Disposal of PCBs Regulations 2000	Current - Final RIA
	Dioxins and Dioxin-like PCBs - UK Dioxins Strategy Group 2005	Proposed - Partial RIA
Packaging & Packaging Waste	Producer Responsibility Obligations (Packaging Waste) Regulations 1997 / 2003	Current and Proposed - Final, Partial and Overarching RIAs
	Packaging (Essential Requirements) Regulations 2003	Current and Proposed - Final and Partial RIAs
Ozone layer Depleting Substances	Controls on Ozone-Depleting Substances Regulations 2002	Current - Final RIA
Shipment of Waste	Transfrontier Shipment of Waste Regulations 1994	Current
	UK management plan for exports and imports of waste 2000	Current
Waste Statistics	EU Regulations on Waste Statistics 2002	Current
SEA	Environmental Assessment of Plans and Programmes Regulations 2004	Current - Final RIA
Batteries	Batteries (containing dangerous substances) 2001 - EU Directive 2003	Under revision - Partial RIA
IPPC	Pollution Prevention and Control Act 1999	Current
	Pollution Prevention and Control Regulations 2000	Current - Final RIA
Biowaste - Sludge	Sludge (Use in Agriculture) Regulations 1989	Current and under revision
Animal By-Products	Animal By-Products Regulations 2003	Current and under revision (draft RIA)
WEEE	WEEE Regulations 2004	Forthcoming - Partial

Themes	Regulatory instruments subjected to costs and benefits assessments	Status
		RIAs
ROHS	ROHS Regulations 2004	Forthcoming - Partial RIAs
Public Participation	PPC (Public Participation) Regulations 2005	Forthcoming - Partial RIA
Emission Trading Schemes	Greenhouse Gas Emissions Trading Scheme Regulations 2005	Current - RIA
	NAP 2004	Current - RIA
	UK Emissions Trading Scheme 2002	Current - RIA
	Climate Change Levy Regulations 2001	Current - RIA on UK Climate Change Programme
Mining Waste	Management of waste from the extractive industries Directive	Proposed - Partial RIA
Eco-design for Energy Using Products	Eco-design obligations in the general line of the EUP Directives	Proposed
PVC	EU Green paper	Current
Integrated Product Policy	EU Green paper and related documents	Current
REACH	Draft Chemicals Legislation	Forthcoming
EU Thematic Strategies	6 th Environment Action Programme	Due 2010
	Soil Protection	Due 2005
	Sustainable Use of Natural Resources	Due 2005
	Recycling & Waste Prevention	Due 2005
	Urban Environment	Due 2005
	UK Sustainable Development Strategy 2005	Current - Final RIA
	Household Waste Recycling Act 2003	Current - Partial RIA
	Waste not, want not 2002	Current
UK Strategies and Other Legislation	Making more with less 2001	Current
	SCP Action Plan 2006	Proposed
	ODPM Sustainable Communities Plan	Current
	PPS10 on Planning for Sustainable Waste Management	Current - Final RIA
	Food Industry Sustainability Strategy (FISS)	Proposed - Partial RIA
Waste crime	Clean Neighbourhoods and Environment Act 2005	Current - Partial RIA
	Fixed-Penalty (Litter and Dog Fouling) Regulations 2004	Proposed
Miscellaneous	Joint Strategies Exemptions and Guidance on the Power of Direction (Waste Management)	Proposed
	Charging For Plant Health Services Provided In Respect Of Export Certification (Including Wood Packaging Material) 2004	Current - Final RIA
	Waste Implementation Programme: Community Sector Support Programme	Proposed

Annex G - Details of scenario calculations underpinning some options

Note on conventions:

- *Costs: Positive costs represent increases in cost over the base line; negative costs represent savings.*
- *Benefits: Positive benefits represent improvements (savings) over the base line; negative benefits represent increased impacts over the base line.*

Municipal waste

Municipal waste options have been evaluated using the LAWRRD model (Annex I). Benefits have been evaluated in terms of greenhouse gases as a proxy for environmental impacts, and evaluated in terms of the social costs of carbon (Annex H).

Option E: National household waste recycling and composting targets

What happens if we reach 52.7% household recycling nationally in 2014/15 and 58.1% household recycling in 2019/20?

Base case summary

	2005/06	2009/10	2012/13	2019/20
Landfill Allowances (kt)	15,196	11,200	7,460	5,220
MSW Arisings (kt)	29,890	31,780	33,270	37,000
BMW to landfill (kt)	13,520	11,180	7,500	5,440
Household recycling / composting (kt)	6,450 (25%)	10,840 (39%)	14,300 (49%)	18,730 (57%)
Energy recovery (kt)	3,440 (12%)	4,530 (15%)	6,780 (21%)	8,280 (23%)
Numer of new facilities (additional to facilities in 2003/04)	77	182	273	442

Option summary

	2005/06	2009/10	2012/13	2019/20
Landfill Allowances (kt)	15,196	11,200	7,460	5,220
MSW Arisings (kt)	29,890	31,780	33,270	37,000
BMW to landfill (kt)	13,520	11,050	7,420	5,180
Household recycling / composting (kt)	6,450 (25%)	11,130 (40%)	14,890 (51%)	19,250 (59%)
Energy recovery (kt)	3,440 (12%)	4,510 (15%)	6,560 (20%)	8,060 (22%)
Numer of new facilities (additional to facilities in 2003/04)	77	197	322	539

Difference

	2005/06	2009/10	2012/13	2019/20
BMW to landfill (kt)	0	-130	-80	-260
Household recycling / composting (kt)	0	290	590	520
Energy recovery (kt)	0	-20	-220	-220
Numer of new facilities (additional to facilities in 2003/04)	0	15	49	97

Benefits

2003/04 to 2019/20 Total Discounted Carbon Impact			2005/06	2009/10	2012/13	2019/20
Discounted 2003/04 Prices	Base Case	Low £m	-£21	-£74	-£128	-£244
		Medium £m	-£39	-£133	-£223	-£402
		High £m	-£75	-£251	-£413	-£718
	Household recycling targets	Low £m	-£21	-£78	-£165	-£265
		Medium £m	-£39	-£140	-£287	-£437
		High £m	-£75	-£264	-£532	-£781
	Difference	Low £m	£0	£4	£37	£21
		Medium £m	£0	£7	£64	£35
		High £m	£0	£13	£119	£63
Total Carbon Impact (tonnes of carbon)			0	86,282	791,975	408,901

Costs

2003/04 to 2019/20		2005/06	2009/10	2012/13	2019/20
Actual Prices	Base Case £m	£2,310	£3,430	£4,150	£5,190
	Household recycling targets £m	£2,310	£3,460	£4,230	£5,300
	Difference £m	£0	£30	£80	£110
Actual Prices	Base Case net of LFT £m	£1,960	£2,970	£3,780	£4,920
	Household recycling targets net of LFT £m	£1,960	£3,010	£3,870	£5,040
	Difference net of LFT £m	£0	£40	£90	£120
2003/04 Prices	Base Case net of LFT £m	£1,890	£2,590	£3,070	£3,350
	Household recycling targets net of LFT £m	£1,890	£2,630	£3,140	£3,430
	Difference net of LFT £m	£0	£30	£70	£80
Discounted	Base Case net of LFT £m	£1,820	£2,420	£2,830	£3,040
	Household recycling targets net of LFT £m	£1,820	£2,450	£2,890	£3,110
	Difference net of LFT £m	£0	£30	£60	£70

Total discounted benefits vs. costs over base case (2003/04-2019/20)

Costs, £m	£770
Carbon benefits – low £m	£320
Carbon benefits – medium £m	£540
Carbon benefits – high £m	£990

Option F1: Local Authority performance standards for recycling and composting

Recycling floor standard of 23% on Local Authorities in 2010.

Option summary

	2005/06	2009/10	2012/13	2019/20
Landfill Allowances (kt)	15,196	11,200	7,460	5,220
MSW Arisings (kt)	29,890	31,780	33,270	37,000
BMW to landfill (kt)	13,520	11,170	7,470	5,510
Household recycling / composting (kt)	6,450 (25%)	10,940 (39%)	14,480 (49%)	18,830 (57%)
Energy recovery (kt)	3,440 (12%)	4,510 (15%)	6,720 (21%)	8,120 (22%)
Numer of new facilities (additional to facilities in 2003/04)	77	198	282	446

Difference from base case

	2005/06	2009/10	2012/13	2019/20
BMW to landfill (kt)	0	-10	-30	70
Household recycling / composting (kt)	0	100	180	100
Energy recovery (kt)	0	-20	-60	-160
Numer of new facilities (additional to facilities in 2003/04)	0	16	9	4

Benefits

2003/04 to 2019/20 Total Discounted Carbon Impact		2005/06	2009/10	2012/13	2019/20	
Discounted 2003/04 Prices	Base Case	Low £m	-£21	-£74	-£128	-£244
		Medium £m	-£39	-£133	-£223	-£402
		High £m	-£75	-£251	-£413	-£718
	Floor target = 23%	Low £m	-£21	-£75	-£129	-£243
		Medium £m	-£39	-£135	-£225	-£401
		High £m	-£75	-£255	-£418	-£716
	Difference	Low £m	£0	£1	£1	-£1
		Medium £m	£0	£2	£2	-£1
		High £m	£0	£4	£4	-£2
Total Carbon Impact (tonnes of carbon)		0	23,615	28,877	-15,245	

Costs

2003/04 to 2019/20		2005/06	2009/10	2012/13	2019/20
Actual Prices	Base Case £m	£2,310	£3,430	£4,150	£5,190
	Floor target = 23% £m	£2,310	£3,450	£4,160	£5,200
	Difference £m	£0	£20	£10	£10
Actual Prices	Base Case net of LFT £m	£1,960	£2,970	£3,780	£4,920
	Floor target = 23% net of LFT £m	£1,960	£2,990	£3,800	£4,920
	Difference net of LFT £m	£0	£20	£10	£10
2003/04 Prices	Base Case net of LFT £m	£1,890	£2,590	£3,070	£3,350
	Floor target = 23% net of LFT £m	£1,890	£2,610	£3,080	£3,360
	Difference net of LFT £m	£0	£20	£10	£10
Discounted	Base Case net of LFT £m	£1,820	£2,420	£2,830	£3,040
	Floor target = 23% net of LFT £m	£1,820	£2,440	£2,840	£3,040
	Difference net of LFT £m	£0	£20	£10	£10

Total discounted benefits vs. costs over base case (2003/04-2019/20)

Costs, £m	£0
Carbon benefits – low £m	-£30
Carbon benefits – medium £m	-£50
Carbon benefits – high £m	-£90

Option F2: Local Authority performance standards for recycling and composting

Recycling floor standard of 25% on Local Authorities in 2010.

Option summary

	2005/06	2009/10	2012/13	2019/20
Landfill Allowances (kt)	15,196	11,200	7,460	5,220
MSW Arisings (kt)	29,890	31,780	33,270	37,000
BMW to landfill (kt)	13,520	11,050	7,480	5,420
Household recycling / composting (kt)	6,450 (25%)	11,130 (40%)	14,420 (49%)	18,860 (56%)
Energy recovery (kt)	3,440 (12%)	4,510 (15%)	6,780 (21%)	8,200 (23%)
Numer of new facilities (additional to facilities in 2003/04)	77	197	280	453

Difference from base case

	2005/06	2009/10	2012/13	2019/20
BMW to landfill (kt)	0	-130	-20	-20
Household recycling / composting (kt)	0	290	120	130
Energy recovery (kt)	0	-20	0	-80
Numer of new facilities (additional to facilities in 2003/04)	0	15	7	11

Benefits

2003/04 to 2019/20 Total Discounted Carbon Impact		2005/06	2009/10	2012/13	2019/20	
Discounted 2003/04 Prices	Base Case	Low £m	-£21	-£74	-£128	-£244
		Medium £m	-£39	-£133	-£223	-£402
		High £m	-£75	-£251	-£413	-£718
	Floor target = 25%	Low £m	-£21	-£78	-£125	-£245
		Medium £m	-£39	-£140	-£218	-£404
		High £m	-£75	-£264	-£405	-£722
	Difference	Low £m	£0	£4	-£3	£1
		Medium £m	£0	£7	-£5	£2
		High £m	£0	£13	-£9	£4
Total Carbon Impact (tonnes of carbon)		0	86,282	-56,928	27,740	

Costs

2003/04 to 2019/20		2005/06	2009/10	2012/13	2019/20
Actual Prices	Base Case £m	£2,310	£3,430	£4,150	£5,190
	Floor target = 25% £m	£2,310	£3,460	£4,150	£5,200
	Difference £m	£0	£30	£0	£10
Actual Prices	Base Case net of LFT £m	£1,960	£2,970	£3,780	£4,920
	Floor target = 25% net of LFT £m	£1,960	£3,010	£3,790	£4,930
	Difference net of LFT £m	£0	£40	£0	£10
2003/04 Prices	Base Case net of LFT £m	£1,890	£2,590	£3,070	£3,350
	Floor target = 25% net of LFT £m	£1,890	£2,630	£3,070	£3,360
	Difference net of LFT £m	£0	£30	£0	£10
Discounted	Base Case net of LFT £m	£1,820	£2,420	£2,830	£3,040
	Floor target = 25% net of LFT £m	£1,820	£2,450	£2,830	£3,040
	Difference net of LFT £m	£0	£30	£0	£10

Total discounted benefits vs. costs over base case (2003/04-2019/20)

Costs, £m	£0
Carbon benefits – low £m	-£40
Carbon benefits – medium £m	-£60
Carbon benefits – high £m	-£120

Option G1: Greater recovery of energy from waste

What would happen if Enhanced capital allowances (ECAs) and WIP support was not available to support EfW?

Option summary

	2005/06	2006/07	2007/08	2008/09
Landfill Allowances (kt)	15,196	11,200	7,460	5,220
MSW Arisings (kt)	29,890	31,780	33,270	37,000
BMW to landfill (kt)	13,520	11,180	7,400	5,490
Household recycling / composting (kt)	6,450 (25%)	10,840 (39%)	14,550 (49%)	18,820 (57%)
Energy recovery (kt)	3,440 (12%)	4,530 (15%)	6,670 (21%)	8,150 (23%)
Numer of new facilities (additional to facilities in 200	77	182	290	438

Difference from base case

	2005/06	2009/10	2012/13	2019/20
BMW to landfill (kt)	0	0	-100	50
Household recycling / composting (kt)	0	0	250	90
Energy recovery (kt)	0	0	-110	-130
Numer of new facilities (additional to facilities in 2003/04)	0	0	17	-4

Benefits

2003/04 to 2019/20 Total Discounted Carbon Impact		2005/06	2009/10	2012/13	2019/20	
Discounted 2003/04 Prices	Base Case	Low £m	-£21	-£74	-£128	-£244
		Medium £m	-£39	-£133	-£223	-£402
		High £m	-£75	-£251	-£413	-£718
	No ECA or WIP support	Low £m	-£21	-£74	-£134	-£245
		Medium £m	-£39	-£133	-£234	-£404
		High £m	-£75	-£251	-£433	-£721
	Difference	Low £m	£0	£0	£6	£1
		Medium £m	£0	£0	£11	£2
		High £m	£0	£0	£20	£3
Total Carbon Impact (tonnes of carbon)		0	0	134,171	21,840	

Costs

2003/04 to 2019/20		2005/06	2009/10	2012/13	2019/20
Actual Prices	Base Case £m	£2,310	£3,430	£4,150	£5,190
	No ECA or WIP support £m	£2,310	£3,430	£4,170	£5,200
	Difference £m	£0	£0	£20	£10
Actual Prices	Base Case net of LFT £m	£1,960	£2,970	£3,780	£4,920
	No ECA or WIP support net of LFT £m	£1,960	£2,970	£3,810	£4,930
	Difference net of LFT £m	£0	£0	£30	£10
2003/04 Prices	Base Case net of LFT £m	£1,890	£2,590	£3,070	£3,350
	No ECA or WIP support net of LFT £m	£1,890	£2,590	£3,090	£3,360
	Difference net of LFT £m	£0	£0	£20	£10
Discounted	Base Case net of LFT £m	£1,820	£2,420	£2,830	£3,040
	No ECA or WIP support net of LFT £m	£1,820	£2,420	£2,850	£3,040
	Difference net of LFT £m	£0	£0	£20	£10

Total discounted benefits vs. costs over base case (2003/04-2019/20)

Costs, £m	£110
Carbon benefits – low £m	£30
Carbon benefits – medium £m	£40
Carbon benefits – high £m	£80

Option G2: Greater recovery of energy from waste

Further support for energy from waste (Local Authorities becoming incineration-neutral).

Option summary

	2005/06	2009/10	2012/13	2019/20
Landfill Allowances (kt)	15,196	11,200	7,460	5,220
MSW Arisings (kt)	29,890	31,780	33,270	37,000
BMW to landfill (kt)	13,520	11,180	7,320	5,140
Household recycling / composting (kt)	6,450 (25%)	10,840 (39%)	13,410 (46%)	17,240 (52%)
Energy recovery (kt)	3,440 (12%)	4,530 (15%)	7,620 (23%)	9,580 (26%)
Numer of new facilities (additional to facilities in 2003/04)	77	182	265	407

Difference from base case

	2005/06	2009/10	2012/13	2019/20
BMW to landfill (kt)	0	0	-180	-300
Household recycling / composting (kt)	0	0	-890	-1,490
Energy recovery (kt)	0	0	840	1,300
Numer of new facilities (additional to facilities in 2003/04)	0	0	-8	-35

Benefits

2003/04 to 2019/20 Total Discounted Carbon Impact		2005/06	2009/10	2012/13	2019/20	
Discounted 2003/04 Prices	Base Case	Low £m	-£21	-£74	-£128	-£244
		Medium £m	-£39	-£133	-£223	-£402
		High £m	-£75	-£251	-£413	-£718
	Household recycling targets	Low £m	-£21	-£74	-£121	-£232
		Medium £m	-£39	-£133	-£212	-£383
		High £m	-£75	-£251	-£392	-£685
	Difference	Low £m	£0	£0	-£7	-£11
		Medium £m	£0	£0	-£11	-£19
		High £m	£0	£0	-£21	-£33
Total Carbon Impact (tonnes of carbon)		0	0	-141,024	-216,270	

Costs

2003/04 to 2019/20		2005/06	2009/10	2012/13	2019/20
Actual Prices	Base Case £m	£2,310	£3,430	£4,150	£5,190
	Household recycling targets £m	£2,310	£3,430	£4,080	£5,060
	Difference £m	£0	£0	-£70	-£130
Actual Prices	Base Case net of LFT £m	£1,960	£2,970	£3,780	£4,920
	Household recycling targets net of LFT £m	£1,960	£2,970	£3,720	£4,800
	Difference net of LFT £m	£0	£0	-£60	-£110
2003/04 Prices	Base Case net of LFT £m	£1,890	£2,590	£3,070	£3,350
	Household recycling targets net of LFT £m	£1,890	£2,590	£3,020	£3,270
	Difference net of LFT £m	£0	£0	-£50	-£80
Discounted	Base Case net of LFT £m	£1,820	£2,420	£2,830	£3,040
	Household recycling targets net of LFT £m	£1,820	£2,420	£2,780	£2,970
	Difference net of LFT £m	£0	£0	-£40	-£70

Total discounted benefits vs. costs over base case (2003/04-2019/20)

Costs, £m	-£530
Carbon benefits – low £m	-£90
Carbon benefits – medium £m	-£160
Carbon benefits – high £m	-£290

Commercial and Industrial waste

Scenario C: Reduction in CI&H waste growth by 0.75% p.a.

Option summary

	2002/03	2007/08	2009/10	2014/15	2019/20
Arisings, kt	66,040	65,790	66,940	71,450	77,690
	Waste Treatment**, kt				
Minimisation		5,040	6,440	8,970	10,850
Re-use	5,960	7,000	6,930	6,860	6,890
Recycling	21,650	27,930	28,520	31,150	34,990
Thermal	1,840	3,910	3,910	4,070	4,380
Treatment	990	5,920	5,890	6,040	6,400
Landfill	35,520	26,880	26,750	27,770	29,850
	Treatment type by percentage of total waste				
Re-use	9%	11%	10%	10%	9%
Recycling	33%	42%	43%	44%	45%
Thermal	3%	6%	6%	6%	6%
Treatment	1%	9%	9%	8%	8%
Landfill***	54%	41%	40%	39%	38%
Additional facilities*		125	134	169	220

* estimated additional to plants in 2002/03

** excludes hazardous liquid wastes

*** includes additional residues landfilled from treatment

Difference from base case¹

kt	2007/08	2009/10	2014/15	2019/20
Minimisation	1340	1880	3180	4460
Re-use	-250	-350	-590	-840
Recycling	-550	-770	-1330	-1880
Thermal	-50	-60	-110	-180
Treatment	-130	-210	-370	-480
Landfill	-540	-760	-1250	-1730
Additional facilities	-8	-11	-19	-29

¹ Note that waste minimisation is assumed to reduce waste flows through all treatment routes (in extremis it obviates the need for other treatment routes), including re-use and recycling

Total discounted benefits vs. costs over base case (2003/04-2019/20)

Costs – low gate fee £m	-£390
Costs – high gate fee £m	-£810
Carbon benefits – low £m	£50
Carbon benefits – medium £m	£90
Carbon benefits – high £m	£160

Scenario D1: EA Sector based waste minimisation targets – New IPPC targets post 2006 and Cement industry targets in place

Option summary

	2002/03	2007/08	2009/10	2014/15	2019/20
Arisings, kt	66,040	66,660	67,670	68,860	76,420
Waste Treatment**, kt					
Minimisation		4,180	5,730	11,480	12,080
Re-use	5,960	7,110	7,020	6,320	6,600
Recycling	21,650	28,310	28,860	30,140	34,520
Thermal	1,840	3,940	3,930	3,990	4,340
Treatment	990	5,980	5,930	5,750	6,260
Landfill	35,520	27,220	27,000	26,790	29,360
Treatment type by percentage of total waste					
Re-use	9%	11%	10%	9%	9%
Recycling	33%	42%	43%	44%	45%
Thermal	3%	6%	6%	6%	6%
Treatment	1%	9%	9%	8%	8%
Landfill***	54%	41%	40%	39%	38%
Additional facilities*		131	137	154	214

* estimated additional to plants in 2002/03

** excludes hazardous liquid wastes

*** includes additional residues landfilled from treatment

Difference from base case¹

kt	2007/08	2009/10	2014/15	2019/20
Minimisation	480	1170	5690	5690
Re-use	-140	-260	-1130	-1130
Recycling	-170	-430	-2340	-2350
Thermal	-20	-40	-190	-220
Treatment	-70	-170	-660	-620
Landfill	-200	-510	-2230	-2220
Additional facilities	-2	-8	-34	-35

¹ Note that waste minimisation is assumed to reduce waste flows through all treatment routes (in extremis it obviates the need for other treatment routes), including re-use and recycling

Total discounted benefits vs. costs over base case (2003/04-2019/20)

Costs – low gate fee £m	-£570
Costs – high gate fee £m	-£1,180
Carbon benefits – low £m	£40
Carbon benefits – medium £m	£70
Carbon benefits – high £m	£130

Scenario D2: Increase in recycling of mixed commercial wastes and composting of commercial and industrial food waste

Option summary

	2002/03	2007/08	2009/10	2014/15	2019/20
Arisings, kt	66,040	67,160	68,860	74,720	82,290
Waste Treatment**, kt					
Minimisation		3,700	4,560	5,790	6,390
Re-use	5,960	7,250	7,280	7,450	7,730
Recycling	21,650	31,000	31,840	35,300	40,070
Thermal	1,840	3,960	3,970	4,180	4,560
Treatment	990	5,730	5,780	6,100	6,570
Landfill	35,520	25,240	25,300	26,570	28,760
Treatment type by percentage of total waste					
Re-use	9%	11%	11%	10%	9%
Recycling	33%	46%	46%	47%	49%
Thermal	3%	6%	6%	6%	6%
Treatment	1%	9%	8%	8%	8%
Landfill***	54%	38%	37%	36%	35%
Additional facilities*		171	184	232	299

* estimated additional to plants in 2002/03

** excludes hazardous liquid wastes

*** includes additional residues landfilled from treatment

Difference from base case

kt	2007/08	2009/10	2014/15	2019/20
Minimisation	0	0	0	0
Re-use	0	0	0	0
Recycling	2520	2550	2820	3200
Thermal	0	0	0	0
Treatment	-320	-320	-310	-310
Landfill	-2180	-2210	-2450	-2820
Additional facilities	38	39	44	50

Total discounted benefits vs. costs over base case (2003/04-2019/20)

Costs – low gate fee £m	-£580
Costs – high gate fee £m	-£100
Carbon benefits – low £m	£160
Carbon benefits – medium £m	£280
Carbon benefits – high £m	£520

Annex H - Environmental modelling

1. The environmental benefits of the options are presented in terms of climate change impacts, expressed as carbon savings. These benefits accrue as:
 - direct benefits of reduced landfill emissions; and
 - off-set benefits of recycling, recovery and greater resource efficiency within product life cycles.
2. This analysis enables an estimate of the environmental impacts to be monetised using the social cost of carbon. This has been applied both to the evaluation of the MSW options and, more crudely, to the evaluation of CI&H options. The method is set out below.

Emission Factors for Waste Treatment Processes

3. Environmental impact factors were taken from a Defra commissioned study by ERM '*Impact of Energy from Waste and Recycling Policy on UK Greenhouse Gas Emissions*'. Disamenity impacts were not considered as estimates only exist for landfill³⁶.
4. The total environmental impact was proxied by the emissions of six green house gas emissions (carbon dioxide, methane, nitrous oxide, PFCs, HFCs & CFCs and SF) expressed as CO₂ equivalents. The emission factors are summarised in Table H1. These are based on a life cycle assessment and include not only the carbon costs of treating and transporting waste, but also the potential benefits where primary resource extraction or electricity generation are off set with energy recovery. (The off set is against combined cycle gas turbine electricity generation.)

MSW Assessment

5. The LAWRRD model (Annex I) produces output for the total amount of tonnages managed through nine different technology types and landfill. The environmental impact of each of these waste management options is dependent on the composition of the waste input.
6. In order to estimate the environmental impact of each of the scenarios modelled, the LAWRRD output was split out by the different elements of the waste stream.

Stage 1

7. Initially the LAWRRD output was split out by material for the recycling and composting options based on expert judgement of the average composition of each of these routes. The assignment of components is given in Table H2.

³⁶ http://defraweb/environment/waste/landfill/pdf/landfill_disamenity.pdf

Table H1: Emission factors for waste treatment processes (kg CO₂ equivalents/tonne of waste processed)

Process	Paper/Card	Kitchen Waste	Garden Waste	Textiles	Fines	Misc. Combustible	Misc. Non-Combustible	Ferrous Metals	Non-Ferrous Metals*	Glass	Plastic Dense	Plastic Flim
Transfer Station	2	2	2	2	2	2	2	2	2	2	2	2
MRF	-479	17	17	-7852	17	17	17	-417	-11617	-745	-2307	-1569
EfW	-392	-124	-124	219	132	202	41	-415	-11615	-45	1118	990
Gasification	-355	-355	-71	249	186	233	-32	-354	-11553	13	1125	1005
Anaerobic Digestion	5	5	5									
Windrow Composting	13		13									
In-Vessel	12	12	12									
MBT with RDF combustion	-335	-71	-71	97	123	86	-40	-366	-11566	2	680	600
MBT with stabilisation	120	83	83	95	68	94	53	-366	-11566	53	53	53
Landfill	272	121	121	171	61	165	3	3	3	3	3	3

* assumes non-ferrous metals are recovered by all processes

Table H2: Assignment of waste components to recovery streams

	Paper/Card	Kitchen Waste	Garden Waste	Textiles	Fines	Misc. Combustible	Misc. Non-Combustible	Ferrous Metals	Non-Ferrous Metals	Glass	Plastic Dense	Plastic Flim
CA site recovery & recycling	22%			1%		13%		54%	1%	10%		
Bring recycling	56%			3%				1%	1%	39%	1%	
MRF	64%			3%				2%	1%	26%	4%	1%
GW composting			100%									
Bio waste composting/digestion		30%	70%									

8. The modelling ensured that a cap was placed on the tonnage of each material recycled / composted equal to the total amount of that material in the waste stream (with excess tonnage apportioned proportionally across the other elements of the waste stream).

Stage 2

9. The composition of residual waste was calculated based on the amount of material initially in the waste stream minus the material recycled and composted in Stage 1. Again the modelling ensured that a cap was placed on the tonnage of each material managed equal to the total amount of that material in the waste stream (with excess tonnage apportioned proportionally across the other elements of the waste stream).

Stage 3

10. The emission factors were combined with the LAWRRD output split out by material to provide the total CO₂ equivalent emissions for each of the options. The impacts associated with transfer stations was not included as the LAWRRD model does not produce estimates of the number of transfer stations required while the number is expected to remain roughly equivalent under the different scenarios modelled.

Stage 4

11. The carbon dioxide emissions were converted to carbon (using a conversion factor of 12/44) and multiplied by Government's estimate of the social cost of carbon³⁷, adjusted for relative price changes³⁸ and discounted³⁹ in order to compare the benefits over time to the related costs.

CI&H Assessment

18. There is sparingly little information on the composition of CI&H wastes. For the purposes of this assessment, the crude assumption was made that CI&H waste can be described in aggregate by a single composition, given in Table H3⁴⁰.

19. Table H3 also includes the emissions factors for these materials when processed by each of the treatment types examined in the CI&H waste analysis. Whilst the match was not perfect - as the emission factor evidence is based on municipal waste treatments - recycling emissions were assumed to be equivalent to MRF, thermal equated to EfW and 'treatment' looked at a range of technologies from sorting to composting. Landfill was assumed similar in both cases.

³⁷ Clarkson R. and K. Deyes (2002) *Estimating the Social Cost of Carbon Emissions*, Government Economic Service Working Paper 140, Defra and HM Treasury.

³⁸ <http://greenbook.treasury.gov.uk/chapter05.htm#adjust>

³⁹ <http://greenbook.treasury.gov.uk/annex06.htm>

⁴⁰ ERM (2006) *Impact of Energy from Waste and Recycling Policy on UK Greenhouse Gas Emissions* Report to Defra - available at <http://www.defra.gov.uk/environment/waste/strategy/review/index.htm>

20. Re-use and minimisation were treated differently. To generate an estimated emissions factor for these, it was assumed that a tonne of waste re-used or minimised would simply avoid a tonne of primary material being produced in the first place. This used non-UK emissions factor for recycling which essentially represents the carbon emissions saved from reducing raw material production. Where there is no well-defined primary production avoided as with mixed wastes, no carbon impact could be assumed in the absence of better information.

21. Weighting the emissions factors for specific waste types by the estimated composition of CI&H waste allows us to estimate an aggregate emissions factor for each treatment type. Applying this to the tonnages of material processed by treatment type gives an estimates level of carbon dioxide emissions from the treatment bundle in the scenario concerned. Comparing this to the base case allows the estimation of the net change in carbon equivalent emissions from the different scenarios.

22. The net changes in tonnes of carbon (converted from the change in CO₂ equivalent emissions) are monetised using the current Defra/HMT guidance on the social cost of carbon.

23. Both the financial impacts and monetised carbon impacts are presented as present values, where by future costs and benefits are discounted in line with the HM Treasury Green Book.

Table H3: Assumed CI&H waste composition and aggregate CO₂ equivalent

C&I Waste Composition		Assumed Emissions Factor by Treatment (kg CO ₂)				
Waste Type	Composition	Recycled	Thermal	Treatment*	Landfill	Minimisation/ Re-Use
Paper	12.7%	-479	-392	2	272	-494
Food/animal waste	9.3%	17	-124	2	121	
Ferrous Metals	4.3%	-417	-415	2	3	-432
Non-ferrous metals	1.1%	-11617	-11615	2	3	-11632
Other mixed general (non-combustible)	47.8%	17	41	2	3	
Other mixed general (organic)	24.8%	17	202	2	165	
Aggregate Emissions Factor per tonne treated (kg CO ₂)		-193	-137	2	89	-209

* The emissions factor here only represents the cost of transporting waste to treatment, given the composition of waste the range of treatment types captures in this category were broadly carbon neutral.

Annex I - The Local Authority Waste Recycling Recovery and Disposal (LAWRRD) Model

1. The Local Authority Waste Recycling Recovery and Disposal (LAWRRD) model has been developed for Defra by AEA Technology. The model is a replacement for the Strategy Unit (SU) model that was created as part of the Cabinet Office SU report 'Waste not Want not'.
2. The model's purpose is to predict local authorities' waste management costs, flows of materials and the facilities needed for waste treatment to meet the EU Landfill Directive targets and increased rates of recycling and recovery. Different policy initiatives can be modelled using the LAWRRD (e.g. different taxes and target rates).
3. LAWRRD is a costs-driven, bottom up model. It models waste management by taking input data on waste arisings, numbers of actual or planned facilities from each local authority in turn and then summing the relevant outputs to develop a picture representing England as a whole. The existing and proposed waste management infrastructure have been identified through local authority surveys and assessment of current PFI applications.
4. Each local authority is assigned to one of up to three 'typologies' (i.e. urban, suburban and rural). The typologies allow user input of waste composition, growth rates, local gate fees and 'pressure factors' reflecting political and practical weighting against certain options (e.g. anti-incineration and non-achievement of targets). The assignment of typology is determined by the socio-economic and demographic characteristics of each area. The typology approach allows for the introduction of local variations in the model that cannot be reflected when the country is, in effect, treated as a single waste disposal authority, as in the SU model.
5. The model works by simulating the decision processes of each waste disposal authority. Each year, the costs of adding different waste management facilities at various operational scales is compared with the cost of making no change to the existing suite of facilities. The cost of each option includes the gate fees, costs of residue treatment and disposal, taxes, the trading of landfill allowances, fines and 'pressure' factors. The gate fees used are illustrated in Table I1
6. Having identified the lowest cost additional plant (or found that 'no change' is cheapest), the model then adds a facility of the selected type to the existing options for that local authority and then repeats the process for the next authority and so on until all authorities have been assessed in that year. LAWRRD then repeats the calculations with increasing incomes and penalties for LATS until a balance point is reached in allowance trading. This then represents the most economic outcome for England as a whole for that trading year (i.e. it allows some authorities to select larger facilities in order to trade the excess allowances generated if economic to do so). The model then proceeds to the next year. It does not allow for banking or borrowing of allowances.

7. By basing decisions on economic costs, the model simulates the main driver for local authority decision making. The LAWRRD model includes waste industry capacity constraint curves to ensure that the number of facilities predicted by LAWRRD do not exceed industries ability to deliver.

8. LAWRRD considers the material flows and costs from collection of recyclates and residual waste via civic amenity (CA) sites, 'bring' and direct recycling and kerbside collection options. The waste management options in the model are placed in a hierarchy⁴¹, in which recyclates are removed at the top of the hierarchy, leaving residues for treatment in the lower levels. The waste flows are illustrated in Figure I1.

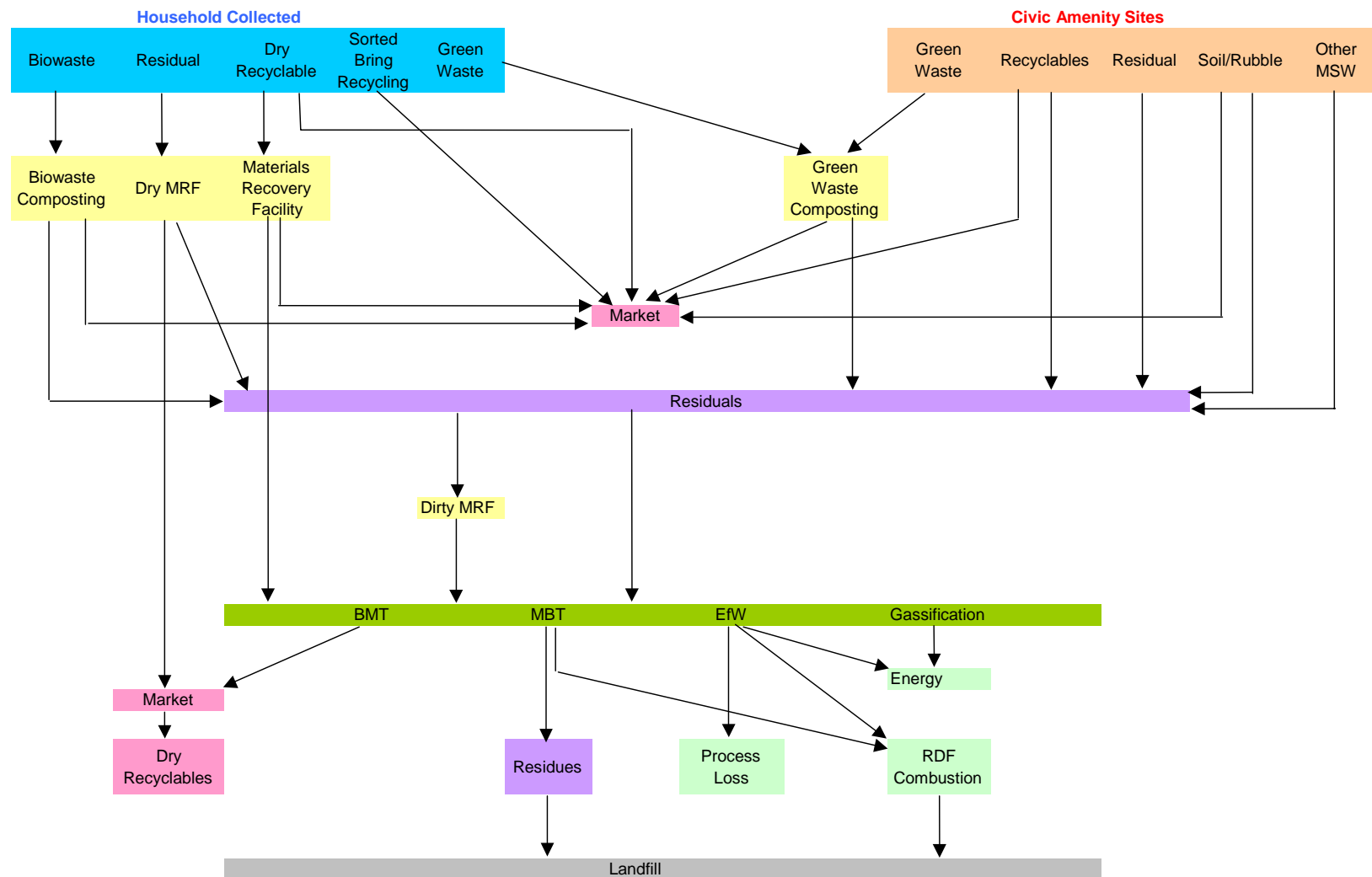
Table I1 LAWRRD Assumed capital and gate fee costs (2003/04 base)¹

	Plant scale kt/y	Capital cost £m	Gate fees £/t (year)	
			2003/04	2009/10
CA Sites		4.40	22.50	25.20
Materials reclamation facilities (MRF)	10	1.70	52.30	68.60
	40	4.60	31.60	41.40
	100	10.30	24.50	32.20
Dirty MRF	70	3.00	38.20	42.80
	150	6.00	34.30	38.40
	250	9.00	31.60	35.30
Green waste composting	10	1.40	43.80	41.40
	30	3.00	33.80	31.90
	50	4.50	20.70	29.40
Biowaste composting/digestion	20	6.00	68.70	76.90
	50	6.80	53.60	60.00
	150	24.00	48.00	53.80
Mechanical treatment/residue to EfW	50	29.90	73.30	113.80
	100	52.60	60.20	88.20
	200	86.80	49.40	67.50
MBT compost/RDF	50	53.00	106.60	181.50
	100	62.50	67.10	105.20
	200	79.50	52.20	66.20
MBT compost and residue landfill	50	15.30	66.80	74.80
	100	23.20	55.60	62.30
	200	35.20	46.60	52.20
EfW incineration	100	54.60	52.50	86.40
	200	88.20	45.70	64.90
	400	125.70	35.80	43.50
ACT Gasification/pyrolysis	30	21.10	127.90	127.90
	100	38.90	81.50	81.50
	150	54.60	70.00	70.00

¹ Gates fees are based on discounted capital costs, operating costs and revenues net of residue landfill costs landfill tax. Capital costs are discounted over typical operating lives for each type of plant, and differ according to typology to reflect land costs.

⁴¹ The hierarchy of treatment options is in descending order, MRF, Dirty MRF, green waste composting, biowaste composting, Bio-Mechanical Treatment with refuse-derived fuel production, MBT with compost /RDF production, MBT with compost produced going to landfill, EfW combustion, Advanced conversion technologies (e.g. pyrolysis and gasification which also recovery energy), residues to landfill.

Figure I1: Waste flows in LAWRRD



Annex J - Commercial and Industrial waste forecasting

REEIO

1. Predictions of commercial and industrial (C&I) waste growth have been derived using the Environment Agency's Regional Economy-Environment Input-Output (REEIO) model, originally developed Cambridge Econometrics for the Environment Agency and the Regional Development Agencies. The model integrates economics growth of industrial sectors (50) with a set of key environmental pressures, including waste.
2. Defra commissioned Cambridge Econometrics to develop the REEIO model into an England-wide model for predicting C&I waste growth based on evidence from the two Environment Agency surveys of C&I waste in 1998/9 and 2002/03.
3. As REEIO only looks at sectoral shift as a driver it is likely to over predict future waste arisings as other factors (including improvements in resource efficiency) act to reduce waste per unit of activity. By examining the difference between the actual level of waste in 2002/03 and a projection from REEIO based on the 1998/9 data, Cambridge Econometrics were able to establish an estimate of the scale of this over prediction. These adjustment factors are incorporated within the model on the assumption that pressures to reduce waste will continue.
4. The model assumes overall economic growth of 2.5% per year in terms of gross value added, but with services generally growing more quickly than manufacturing and different sectors growing at different rates within this.
5. By integrating sectoral growth data with detailed waste data from the Environment Agency, REEIO could therefore be used to forecast waste arisings by industry type and also by material. This provided the base line projections of waste arisings used in this pRIA.

HMCE landfill tax model

6. HMCE's landfill tax model was developed with the primary purpose of predicting levels of landfilling under various tax rate scenarios, and hence to deduce future levels of tax receipts. The model also predicts the amount of waste diverted from landfill when the landfill tax increases, but it does not identify where that waste ultimately goes. The latter can only be derived from a full cost curve-based model.
7. The model combines forecasts of the total level of waste with estimates of the own price elasticity of demand for landfill⁴² and marginal cost estimates of the cost of alternative treatment technologies to examine landfill diversion resulting from the landfill tax escalator.

⁴² Taken from previous Defra studies, e.g. Aspinwall (1999) and Enviro (2001 and 2002)

8. The model has been used here with output from the REEIO model to estimate the impact of future landfill tax on commercial and industrial waste diversion from landfill.