APPENDIX FOUR b

DETERMINING THE COSTS OF MEETING THE EPS AND CARBON INTENSITY FLOOR

global environmental solutions

Final Report

Lifecycle greenhouse gas performance for municipal waste management activities
Determining the cost of meeting the EPS and Carbon Intensity Floor

MAYOR OF LONDON

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EXECUTIVE SUMMARY

The GLA has undertaken work that has resulted in a life cycle greenhouse gas emissions performance standard (EPS) being developed for the management of London's municipal waste. London's waste authorities in undertaking their waste management functions will need to ensure the collection, treatment, energy generation and final disposal of municipal waste collectively meets the EPS, or demonstrate steps and in place to meet it in the near future.

Energy generation, as a way of treating municipal waste, needs to work with other elements of municipal waste management to help meet the whole waste system's EPS. In meeting the EPS it is proposed that a carbon intensity floor be set, whereby any energy generated from London's municipal waste should be no more polluting in carbon terms than the source of energy generation it displaces. This approach aligns the Mayor's waste management goals with is goals for low carbon decentralised energy as set out in his draft Climate Change Mitigation and Energy Strategy (CCMES)[1].

In order to establish the financial and technical implications associated with this new approach the GLA has commissioned research work (this project) to examine the waste management activities that would enable waste authorities to best meet the EPS and meet the carbon intensity floor and to financially and technically appraise these options.

To inform the analysis contact was made with pre-treatment and energy generation waste facility operators to seek data on the proportion of materials produced for energy, recycling, rejects, water loss and other processes and to obtain information on the biomass CV content from waste treated at these facilities where available. As well as existing operators, emphasis was placed on contacting new market entrants and demonstrator facility operators to explore potential opportunities for producing high biomass fuel from waste.

In order to satisfy the requirements of the Brief SLR has set up a Microsoft Excel based options assessment model to generate and analyse a number of potential scenarios. In total the model has the potential to analyse over 2,000 waste management scenarios which cover both existing technical practices and future scenarios based on a range of collection, pre-treatment and energy recovery solutions for recyclates, food and residual waste. The current model includes a number of spare slots for additional technologies and waste composition scenarios (for future use by the GLA).

The scenarios are based on waste management technologies that are either commercially available at present or near to proving commercial viability and that are capable of offering affordable solutions in today's market. Technical and economic data used to define the technologies are based on a combination of information submitted by technology companies and information from SLR databases. The list of technologies modelled is shown in Table ES1[2].

The current model, and the results presented in this report, includes 200 base waste management scenarios and assesses 5 waste composition scenarios; in total 1,000 scenarios are assessed when food waste management sub scenarios are included.

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1 The Mayor's draft climate change mitigation and energy strategy, October 2010 www.london.gov.uk
2 The technology providers are not identified by name in the results due to confidentiality restrictions.

The modelling assesses the whole municipal waste system from waste collection through to final reprocessing/treatment/disposal, and includes recycling, composting, pre-treatment and energy generation options.

Table ES1: Technology Scenarios Available within the Model

Technology Type								
MHT	**MBT aerobic**	**MBT biostabilisation**	**MBT AD**	**Incineration**	**Gasification**	**Gasification with gas engines**	**True pyrolysis**	**Dirty MRF**
MHT 1	MBT aerobic 1	MBT biostab 1	MBT AD 1 (Landfill)	Incineration 1 (electricity only)	Gasification 1	Gasification Gas Engine 1	True Pyrolysis 1	Dirty MRF 1
MHT 2*	MBT aerobic 2 (Landfill)	MBT biostab 2 (Spare)	MBT AD 2 (SRF)	Incineration 2 (low CHP)	Gasification 2	Gasification Gas Engine 2	True Pyrolysis 2 (Spare)	Dirty MRF 2 (Spare)
MHT 3 (Spare)	MBT aerobic 3		MBT AD 3 (Spare)	Incineration 3 (medium CHP)	Gasification 3 (Spare)	Gasification Gas Engine 3 (Spare)	True Pyrolysis 3 (Spare)	
	MBT aerobic 4*			Incineration 4 (high CHP)	Gasification 4 (Spare)			
	MBT aerobic 5 (Spare)			Incineration 5 (medium efficiency electricity)				

Note: * These technologies are capable of producing a high biomass SRF.

Given the considerable number of scenarios, the results are presented in graphical form as a scatter plot. The following sub sections present the scatter plots for the carbon intensity floor and EPS respectively.

Performance against the Carbon Intensity Floor

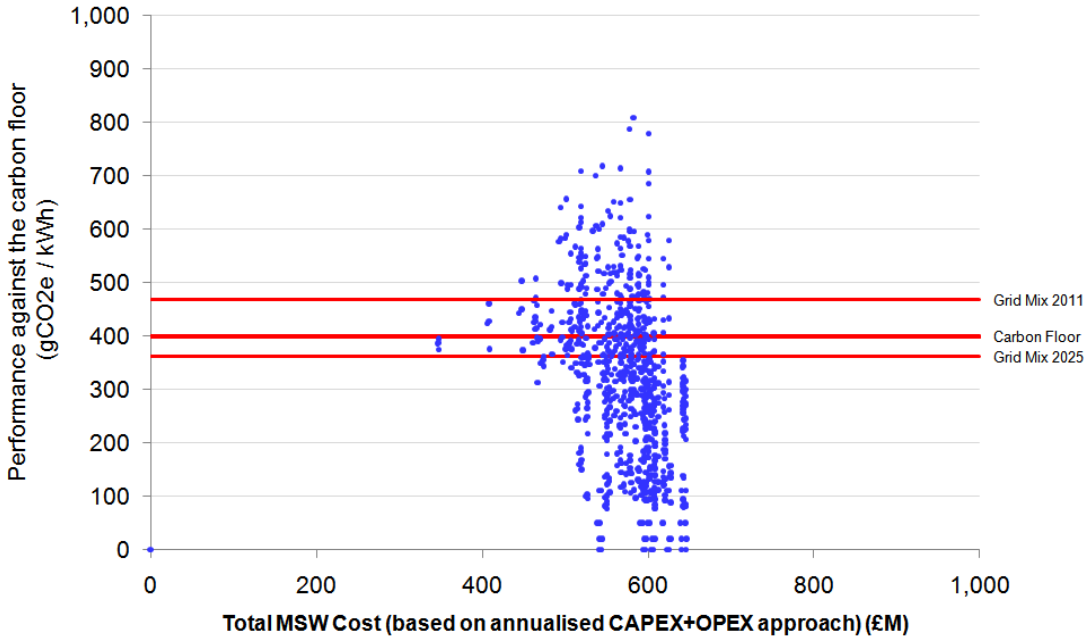
The carbon intensity floor is a measure of the carbon impact of generating energy from waste and is measured as grams of carbon dioxide equivalent per unit of electricity generation (gCO2e/kWh). The ability to meet the carbon intensity floor is affected by three key variables:

- the efficiency of technology employed, for example, the efficiency of incineration or gasification;
- the amount of biomass (e.g. food, green garden and paper/card materials) in the waste that is supplied to the facility, as higher levels of biomass make it easier to meet the carbon intensity floor;
- the carbon intensity of the energy sources being displaced.

Of the 1,000 scenarios modelled, 990 scenarios result in electricity and heat generation from residual and food waste management and thus feature on the scatter plots below. The ten other scenarios do not result in a carbon intensity performance figure, and these are scenarios where food waste is treated by aerobic digestion and the residual waste treatment process does not involve any thermal processing (MBT aerobic biostabilisation and MBT with SRF to landfill).

The costs of individual scenarios and corresponding carbon intensity performance are depicted in Figure ES1 with the carbon floor level, and grid mix emissions in 2011 and predicted for 2025 overlain as red lines. Scenarios that fall below the red lines exceed the carbon intensity floor; conversely scenarios above the red line fail to achieve the carbon intensity floor.

Figure ES1: Carbon Intensity Floor versus Total Cost (Net)



A table summarising the numbers of scenarios achieving the Carbon Intensity Floor is presented below.

Table ES2: Recycling Options and Performance against the Carbon Intensity Floor

Recycling Scenario	Scenario definition	Number of Scenarios achieving Carbon Intensity Floor	Total number of scenarios modelled	% achieving Carbon Intensity Floor
NC	Do Nothing New (based on London's 2008/09 waste management performance including 25 per cent recycling and composting performance	157	200	79%
lo	25 per cent recycling and composting rate, concentrating on dry recyclables only	162	200	81%
mid -d	Focus on dry recycling without food waste collections achieving 45 per cent recycling rate	139	200	70%
mid -f	Focus on food collection achieving 45 per cent recycling and composting performance through a combination of mixed dry and food collections	133	200	67%
hi	Max GHG abatement achieving 60 per cent recycling and composting rate with particular emphasis on food waste collection	136	200	68%

Table ES2 illustrates that all recycling scenarios exhibit a high proportion of scenarios that are capable of achieving the Carbon Intensity Floor. As such it can be concluded that the carbon intensity floor is achievable across a range of recycling and composting scenarios (and thus residual waste compositions).

The ten scenarios performing closest to the carbon intensity floor level of 400gCO_2e/kWh are presented in Table ES3.

Table ES3: Ten Scenarios Closest to the 400gCO_2e/kWh Level (all scenarios meet the EPS in 2031)

Option name	Food treatment technology	Fraction of municipal waste recycled (including residual treatment outputs)	Fraction of municipal waste diverted	Total collection cost (£M)	Total gate fee cost (Inc collection costs) (£M)	Total CAPEX+OPEX (Inc collection costs) (£M)	Net electrical power output (GWh)	Net heat output (GWh)	Net combined energy recovery (GWh)	Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	Achievement of Carbon Floor (Y/N)	EPS (mass) (tCO2e/tonne)	Achievement of the EPS (Y/N)	Total collection cost (£/t)	Total CAPEX+OPEX Disposal Cost (£/t)
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	69%	90%	402	549	568	1,011	0	1,011.41	398.36	Y	-0.27	Y	105.12	43.45
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	69%	90%	402	549	567	1,011	0	1,011.41	398.36	Y	-0.27	Y	105.12	43.30
mid -d recycling, True Pyrolysis 1_total	Dry AD with electricity generation	74%	99%	368	528	497	1,108	0	1,108.02	398.13	Y	-0.32	Y	96.27	33.66
lo recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	70%	91%	418	563	578	855	0	855.09	397.93	Y	-0.38	Y	109.48	41.81
lo recycling, Gasification 1_total	Dry AD with electricity generation	74%	99%	418	586	466	1,193	0	1,193.26	397.43	Y	-0.28	Y	109.48	12.36
hi recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	82%	99%	458	563	578	1,036	0	1,035.57	397.20	Y	-0.38	Y	119.76	31.51
hi recycling, MBT AD 1 (Landfill), SRF to incineration_generic	Dry AD with electricity generation	79%	95%	458	588	597	899	0	899.22	397.09	Y	-0.33	Y	119.76	36.40
mid -d recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	74%	99%	368	528	525	913	320	1,232.49	395.96	Y	-0.31	Y	96.27	41.18
mid -d recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	74%	99%	368	528	525	913	320	1,232.49	395.96	Y	-0.31	Y	96.27	41.10
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	75%	98%	402	514	548	1,136	0	1,136.09	395.52	Y	-0.34	Y	105.12	38.21

A number of key conclusions relating to the Carbon Intensity performance of scenarios are summarised below:

- The carbon intensity floor for electricity generation can be achieved via the full range of recycling options. Recycling options that concentrate on high embedded carbon materials such as metals, plastics and textiles can be beneficial due to the higher organic component left in the residual waste stream and thus higher calorific value from biomass;
- The efficiency of energy recovery is a key factor with respect to whether the carbon intensity floor level of 400 gCO_2e/kWh can be achieved. In general scenarios generating electricity from residual waste can achieve the carbon intensity floor if the waste exhibits high biomass content and/or a high energy efficiency facility is utilised;
- The treatment of food waste through Anaerobic Digestion (with energy recovery, biogas injection to grid, or biogas converted to a transport fuel) results in a low carbon intensity performance due to the 100 per cent biogenic nature of the feedstock. Thus, the treatment of food waste via AD as opposed to IVC can assist in reducing the overall carbon intensity performance of the waste management solution;
- As a zero carbon impact technology AD offers the opportunity to compensate for high carbon intensity residual treatment options such that the aggregated carbon intensity performance of a scenario is able to achieve the Carbon Intensity Floor.

In summary, based on the modelling undertaken and the scenarios assessed, the Carbon Intensity Floor level set as 400 gCO_2e/kWh results in a position where a significant number of recycling and residual waste management scenarios are capable of achieving the level or exceeding the requirement.

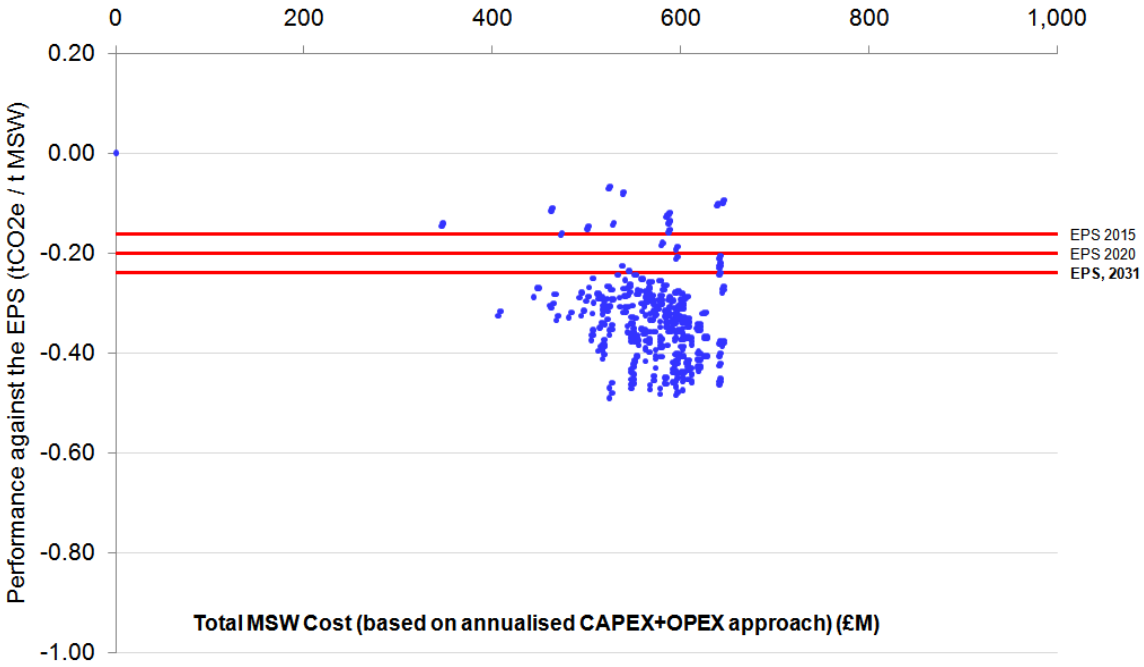
Performance against the EPS

The EPS is a measure of the carbon footprint of waste management measured as tonnes carbon dioxide equivalent per tonne of MSW managed (tCO_2e/ tMSW). Meeting the carbon intensity floor for energy generated from waste forms and important part in meeting the EPS.

Performance of the modelled scenarios compared to the EPS (for different years) is depicted in Figure ES2; each scenario is shown as a single point characterised by carbon emissions and cost. Scenarios that fall below the red line meet the EPS; conversely those above the red line fail to meet the EPS.

In total, 883 of the 1,000 scenarios modelled meet the EPS in the year 2031 (currently set at -0.24 tCO_2e/tMSW).The majority of scenarios which do not achieve the EPS in 2031 are based on No Change recycling, with a small number of scenarios based on Mid-F recycling. Incineration high CHP and the higher performing MBT technologies (with higher diversion of recyclable materials) are the only technology scenarios to achieve the EPS in the No Change recycling scenarios.

Figure ES2: EPS versus Total Waste Management Cost (Net Costs)



The numbers of scenarios achieving the EPS in each target year is presented in Table ES4; demonstrating that the reduction in EPS level between target years results in a reduction of scenarios able to meet the EPS level.

Table ES4: Scenarios Achieving EPS in Key Target Years

	2015	2020	2031
Scenarios achieving EPS	965	916	883
% of scenarios achieving EPS	97%	92%	88%

A number of key conclusions relating to the EPS are summarised below:

- The modelling undertaken indicates that the EPS can be achieved by a range of recycling options and technical scenarios. In total, 88% of the scenarios assessed are shown to meet the EPS in 2031;
- The majority of scenarios which do not meet the EPS in 2031 are based on No Change recycling performance;
- The scenarios with higher recycling performance (in particular recyclables with high embodied carbon content) perform well against the EPS;
- The lowest collection cost per tonne scenarios are those No Change scenarios, as the cost of collecting dry recyclables and organics is greater than for residual materials. With respect to disposal costs, the scenarios offering the lowest cost per tonne (and achieving the carbon intensity floor and EPS) are gasification and Incineration technologies without pretreatment;
- Technology scenarios with high electrical energy efficiency or operating in CHP mode also perform well against the EPS;
- Scenarios that include SRF to cement kilns perform well because 100% of the SRF energy is displacing the conventional fuel (primarily coal);
- The EPS is flexible, in that it can be achieved through a combination of recycling, food waste, pre-treatment and residual waste management approaches; achieving high performance is dependent on achieving an optimum balance of all of these elements;

- The current predicted spend on municipal waste management in London is circa £580m per annum[3]. Assessing the NC (no change/do nothing new) scenario using London s 2009/10 municipal waste management methods, the model generates a gross annual Capex and Opex cost estimate of £639m in 2031. The gross figures are presented, as authorities may not see the full benefit of all revenue streams (recyclate sales and energy generation). The model generates a net annual Capex and Opex cost estimate of £614m.

In summary, the modelling undertaken indicates that the EPS target in 2031 of -0.24 tCO_2e/t waste can be met or exceeded through a range of waste management scenarios providing Authorities with the flexibility to adopt waste management approaches that suit their own particular circumstances.

Performance against the Carbon Intensity Floor and EPS

In total, 658 of the 1,000 scenarios assessed in the model achieve the EPS in 2031 (-0.24 tCO_2e/t or below) and perform at or below the Carbon intensity Floor Level (400 gCO_2e/kWh). The highest performing treatment technologies by recycling options and technology type are displayed in Table ES5.

In terms of whole system municipal costs (net annualised Capex and Opex basis), the majority of scenarios meeting the carbon intensity floor and EPS sit between £405m and £645m, with the largest proportion of the scenarios between £550m to £625m.

3 Mayor's Draft Municipal Waste Management Strategy, January 2010.

Table ES5: Numbers of Scenarios Achieving the Carbon Intensity Floor and EPS (2031) Requirements[4]

Recycling scenario → Technology scenarios ↓	NC 25%	Lo 25%	mid –d 45%	mid –f 45%	Hi 60%	Total	% of total scenarios modelled
Direct to Incineration 4 (high CHP)	5	5	5	5	5	25	100%
MBT aerobic 4*	20	19	18	18	17	92	92%
MHT 2*	16	25	25	24	23	113	90%
MBT AD 2	10	20	20	19	18	87	87%
MHT 1	10	19	20	18	17	84	84%
Dirty MRF 1	10	9	6	6	5	36	72%
Direct to Incineration 3 (medium CHP)	0	5	5	4	3	17	68%
MBT aerobic 1	0	4	4	4	4	16	64%
MBT aerobic 2 (Landfill)	0	4	4	4	4	16	64%
MBT AD 1 (Landfill)	0	4	4	2	4	14	56%
MBT aerobic 3	10	13	7	10	13	53	53%
Direct to Gasification Gas Engine 2	0	4	4	2	2	12	48%
Direct to True Pyrolysis 1	0	4	4	2	2	12	48%
MBT aerobic 1	7	13	7	9	11	47	47%
Direct to Gasification 1	0	4	2	2	2	10	40%
Direct to Gasification Gas Engine 1	0	4	2	2	2	10	40%
Direct to Incineration 2 (low CHP)	0	2	2	2	2	8	32%
Direct Incineration 1 (electricity only)	0	2	0	0	2	4	16%
Direct Gasification 2	0	2	0	0	0	2	8%
Direct to Incineration 5 (medium efficiency electricity)	0	0	0	0	0	0	0%

Notes: * These technologies are capable of producing a high biomass SRF.
SRF generated from Pretreatment technologies (MHT, MBT and Dirty MRF) is treated via a number of options - incineration (electricity only), cement kiln, gasification (electricity only) or power station. MHT 1 also includes SRF to gasification (CHP).
Gasification and pyrolysis technologies where MSW is treated directly are assumed to include a degree of on-site pretreatment

4 Technology scenarios are defined in Appendix A.

Performance of Energy from Waste Options

The model includes a number of different options for energy generation including incineration with and without CHP, cement kilns, co-firing in coal fired power stations and advanced thermal treatment plants with and without CHP.

Consideration has been given to how these technologies perform as illustrated in Table ES6. The figures presented are for a scenario where food waste is treated through Aerobic Digestion, and thus the carbon intensity floor performance is associated with the residual treatment only; the mid-f recycling scenario is used as an example.

Table ES6: Performance Comparison of different Energy from Waste Options (untreated waste to Energy from Waste, or pretreatment technologies with High Biomass SRF to Energy from Waste)

AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs
				Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection
Aerobic Digestion	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	471.66	-0.31	2031	595.5
Aerobic Digestion	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	126.95	-0.42	2031	595.5
Aerobic Digestion	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	428.83	-0.32	2031	595.5
Aerobic Digestion	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	351.04	-0.41	2031	595.5
Aerobic Digestion	mid -f	MBT aerobic 1	incineration_generic	30%	0%	-	38%	714.82	-0.26	2031	566.2
Aerobic Digestion	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	192.23	-0.36	2031	566.2
Aerobic Digestion	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	649.37	-0.27	2031	566.2
Aerobic Digestion	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	531.55	-0.37	2031	566.2
Aerobic Digestion	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	0.00	-0.28	2031	596.8
Aerobic Digestion	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	0.00	-0.28	2031	594.2
Aerobic Digestion	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	480.19	-0.30	2031	562.8
Aerobic Digestion	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	415.95	-0.30	2031	571.0
Aerobic Digestion	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	123.01	-0.46	2031	571.0
Aerobic Digestion	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	377.32	-0.32	2031	571.0
Aerobic Digestion	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	316.21	-0.45	2031	571.0
Aerobic Digestion	mid -f	Incineration 1 (electricity only)_total	#N/A	30%	0%	52%		555.21	-0.25	2031	506.4
Aerobic Digestion	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		523.96	-0.26	2031	568.1
Aerobic Digestion	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		418.53	-0.29	2031	565.4
Aerobic Digestion	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		298.42	-0.35	2031	557.9
Aerobic Digestion	mid -f	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	52%		700.42	-0.23	2020	537.2
Aerobic Digestion	mid -f	Gasification 1_total	#N/A	30%	0%	52%		504.17	-0.27	2031	447.8
Aerobic Digestion	mid -f	Gasification 2_total	#N/A	21%	0%	52%		718.60	-0.24	2020	544.6
Aerobic Digestion	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		489.49	-0.27	2031	525.7
Aerobic Digestion	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		461.54	-0.28	2031	511.5
Aerobic Digestion	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		465.12	-0.27	2031	539.2
Aerobic Digestion	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	492.11	-0.33	2031	547.7
Aerobic Digestion	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	446.99	-0.34	2031	547.7
Aerobic Digestion	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	186.04	-0.40	2031	595.5

Although Table ES6 is not a comprehensive list of energy generation options it does illustrate the benefit of cement kilns against the carbon floor and the EPS; it also shows the benefit of CHP enabled gasification as compared to electricity only incineration and electricity only gasification (ATT_generic).

Performance of Pre-treatment Technologies

Pre-treatment technologies offer the opportunity to recover additional recyclables and to condition the residual waste prior to energy generation. The choice of pre-treatment technology, therefore, has a direct impact on performance against the carbon intensity floor and EPS. The model includes a number of pre-treatment technologies as follows[5]:

- MHT – Mechanical Heat Treatment / Autoclaving;
- MBT aerobic – Mechanical Biological Treatment with biodrying;
- MBT AD - Mechanical Biological Treatment utilising anaerobic digestion;
- Dirty MRF – Material Recycling Facility.

Performance of the pre-treatment technologies is illustrated in Table ES7.

Table ES7: Number of Pre-treatment Technologies Meeting the Carbon Intensity Floor and EPS (2031)

	Secondary Treatment							
Primary Technology	Gasification (electricity only)	Cement Kiln	Gasification CHP	Incineration (electricity only)	Power Station	Landfill	Total	% of total scenarios
MHT 1	18	25	0	17	24	0	84	84%
MHT 2	20	25	25	18	25	0	113	90%
MBT aerobic 1	6	25	0	4	12	0	47	47%
MBT aerobic 2 (Landfill)	0	0	0	0	0	16	16	64%
MBT aerobic 3	6	25	0	4	18	0	53	53%
MBT aerobic 4	22	25	0	21	24	0	92	92%
MBT biostab 1	0	0	0	0	0	16	16	64%
MBT AD 1 (Landfill)	0	0	0	14	0	0	14	56%
MBT AD 2 (SRF)	19	25	0	18	25	0	87	87%
Dirty MRF 1	21	0	0	15	0	0	36	72%
Total	**112**	**150**	**25**	**111**	**128**	**32**	**558**	**74%**

The majority of pre-treatment technologies are shown to deliver a high level of compliance against the carbon intensity floor and EPS; however certain technologies, for example forms of mechanical heat treatment or MBT with high levels of recovery, perform well against the carbon intensity floor and EPS with over 90% of scenarios meeting or exceeding the minimum targets.

Technical Feasibility Assessment

The analysis undertaken by SLR and others indicates that CHP operation represents an important factor in determining performance against the carbon intensity floor and EPS. Whilst the analysis indicates a benefit attributable to CHP it is important to understand the various factors that can affect whether CHP systems are commercially viable.

Equally, it is important to understand the commercial and technical implications that may affect production and subsequent utilisation of high biomass fuels derived from municipal waste. The report seeks to identify issues and opportunities with respect to CHP systems and high biomass fuels.

5 The list of primary technologies includes MBT biostabilisation – Mechanical Biological Treatment with full biostabilisation which is not a pre-treatment technology as the outputs are consigned to landfill

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1 INTRODUCTION

1.1 Project Background

The Mayor of London is preparing a new Municipal Waste Management Strategy (MWMS) which focuses on carbon and the need to include policies to contribute to the reduction of greenhouse gas emissions. Policies will also seek to exceed landfill directive and recycling targets set out in the UK Waste Strategy 2007. Intrinsically linked to this commitment is a requirement to maximise the carbon benefit of using waste in order to displace conventional and non-renewable material and fuel sources.

The GLA has undertaken work that has resulted in a life cycle greenhouse gas emissions performance standard (EPS) being developed. In meeting the EPS it is proposed that a carbon intensity floor be set, whereby any energy generated from London's municipal waste should be no more polluting in carbon terms than the source of energy generation it displaces. Based on the latest Defra guidance[6] for studies of this nature, the marginal source of generation which is considered to be displaced is the combined cycle gas turbine (CCGT) plant.

In order to establish the financial and technical implications associated with this new approach the GLA has commissioned research work (this project) to examine the waste management activities that would enable waste authorities to best meet the carbon intensity floor and to financially and technically appraise these options.

The project scope requires that a range of waste collection and treatment scenarios are technically and financially appraised and that the choice of scenarios will need to include a range of high and low biomass waste compositions going for energy generation. Relevant activities will cover the full scope of an integrated waste management service including options to modify waste collection activities to capture additional materials with high embodied carbon content (namely metals and plastics) through to pre-treatment technologies to produce a solid recovered fuel (SRF) that could subsequently be used for energy generation and recovery.

Finally, it is a requirement that the results of the option analysis should be compared alongside 1) how London performs against the carbon floor today and 2) how the waste scenarios modelled would perform against DECC-approved grid emission factor projections.

1.2 The Emerging Carbon Agenda

The Mayor has set out his aspiration that management of all London's municipal waste achieves a positive carbon outcome, particularly for waste that currently goes to landfill or mass-burn incineration.

The draft MWMS includes a Policy for setting a greenhouse gas (GHG) emissions standard for municipal waste management activities to reduce their impact on climate change (Policy 2).

To deliver these policy objectives the Mayor will set a minimum lifecycle CO_2 equivalent emissions performance standard (EPS) for the management of London's municipal waste.

6 DECC (2010) Valuation of Energy Use and Greenhouse Gas Emissions for Appraisal and Evaluation [online] available at http://www.decc.gov.uk/en/content/cms/statistics/analysts_group/analysts_group.aspx

All waste authorities will be expected to ensure waste management activities associated with the collection, transport, treatment, energy recovery, and final disposal of waste collectively meet this standard, or demonstrate that they have steps in place to meet it in the near future.

This approach is intended to support waste activities and services that reduce the amount of municipal waste produced, and capture the greatest number and highest quality of materials for reuse, recycling or composting.

Furthermore, the approach is intended to incentivise a move towards cleaner, efficient energy recovery techniques for treating London's municipal waste, particularly where both heat and power generated are used.

This latter approach is supported by research undertaken by the GLA[7] which demonstrates that energy generation using mixed waste operating in combined heat and power mode can be carbon neutral, by avoiding CO_2 that would otherwise have been produced from generating the same amount of heat and electricity using fossil fuels, such as coal and gas.

1.3 Introduction to the EPS

The Mayor of London's draft MWMS was published for public consultation in October 2010. A core objective of the MWMS is to develop a greenhouse gas (GHG) emissions performance standard (EPS) for the management of London's municipal solid waste (MSW). The GHGs falling within the scope of the EPS include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) emitted during waste management activities including recycling, treatment and landfill. For simplicity, and in line global GHG accounting protocols, all non-CO_2 emissions are converted to CO_2 equivalents (CO_2e) for measurement against the EPS.

The EPS concept is an increasingly popular way of regional and national authorities managing carbon emissions in the industrial, manufacturing and power generation sectors. Following an announcement by the new coalition Government in May, the Department of Energy and Climate Change (DECC) is currently developing an EPS for all new thermal power stations, which might be achieved by either coal-fired or combined cycle gas turbine (CCGT) power stations through fitting of carbon capture and storage (CCS) infrastructure. The development of an EPS for London is therefore consistent with such approaches being undertaken at a national level.

Work carried out by Eunomia [8] proposed an EPS target (level) for London's municipal waste activities based on the modelling of six key scenarios which meet the recycling and composting targets set within the draft MWMS. This work was revised in spring 2011 and resulted in an EPS of -0.13 kg of CO_2e per tonne of waste managed(kg CO_2e/t) in 2015 further reducing to -0.24kgCO_2e/t in 2031.

1.4 Carbon Intensity Floor for Energy Generation

The carbon intensity floor (CIF) measures the carbon dioxide emissions for each unit of energy generated. In developing the draft MWMS the Mayor proposes that all London's MSW used for energy generation should exhibit a carbon intensity (kgCO_2e/kWh) less than, or equal to, the source of energy generation it displaces (otherwise known as the 'marginal source' of generation), regardless of the location of the facility. In setting this goal the Mayor

7 Greenhouse gas balances of waste management scenarios, GLA January 2008.
8 http://www.london.gov.uk/sites/default/files/GLA001MWS%20APPENDIX%204b.pdf

is aligning the MWMS with his Climate Change Mitigation and Energy Strategy (CCMES) for delivering low carbon energy in London.

Based on the latest Defra guidance for studies of this nature[9] , the 'marginal' source of energy generation is combined cycle gas turbine (CCGT) plant. Such facilities are assumed to generate electricity at a carbon intensity of 393g of CO_2 emissions per kilowatt hour of electricity produced (CO_2e/kWh). This marginal electricity emissions factor is projected to remain constant at 393gCO_2e/kWh until at least 2025.

Taking into account Defra's latest guidance document, recommendations from a Peer Review of the original Eunomia study[10] and draft results from this study, the GLA has decided to set the Carbon Intensity Floor at 400 gCO_2e/kWh. It is currently intended that the Carbon Intensity Floor will remain at the level 400 gCO_2e/kWh until 2031, although this will reviewed on a periodic basis by the GLA in line with Defra guidance.

To achieve alignment with the Mayor's wider approach in the CCMES for appraising all types of energy generation plant in London, performance against the carbon intensity 'floor' should focus on modelling of emissions from the facility alone. As such the scope of the 'life-cycle' boundaries should:

- Exclude any CO_2 benefits of materials capture and subsequent reprocessing;
- Exclude the emissions from any reject streams sent to landfill;
- Exclude the parasitic load of fuel preparation facilities, but include the 'parasitic load' of facilities generating energy;
- Exclude direct emissions (including N_2O) from fuel preparation facilities; and
- Include the benefits of heat production and subsequent use when operating in CHP mode.

As an alternative to Incineration some waste authorities are developing plans based on production of SRF for use in cement kilns or power stations. Furthermore, certain technologies concentrate on producing liquid or gaseous fuels rather than on the generation of electricity. As a consequence, the following exceptions to the EPS have been adopted:

- Where the generation of biofuels from waste is used to displace very carbon intensive fossil fuels such as petrol and diesel, waste authorities following this approach will be assumed to have met the EPS if there is a minimum of 50% biomass in the feedstock sent for processing.

- Where solid recovered fuel (SRF) is employed for energy recovery at a cement kiln it will be assumed, as for biofuels that waste authorities following this approach will meet the EPS if there is a minimum of 50% biomass in the feedstock sent for processing.

1.5 Purpose of this Research

The previous work by Eunomia identified a range of ways of meeting the EPS and carbon intensity floor through a combination of enhanced recycling, treatment of separately

9 DECC (2010) Valuation of Energy Use and Greenhouse Gas Emissions for Appraisal and Evaluation [online] available at http://www.decc.gov.uk/en/content/cms/statistics/analysts_group/analysts_group.aspx
10 Development of a Greenhouse Gas Emissions Performance Standard for London's Municipal Waste, August 2010 http://www.london.gov.uk/sites/default/files/GLA001MWS%20APPENDIX%204b.pdf

collected food wastes, pre-treatment of residual waste to recover further recyclables and condition the waste, and high efficiency energy recovery.

During public consultation on the draft MWMS, stakeholders (particularly waste authorities) requested that a more robust financial evaluation be undertaken to support the EPS as part of the overall approach taken by the GLA in the development of the MWMS

The purpose of this piece of research is to rectify this situation by providing an extensive analysis of the financial and technical implications of meeting the EPS and the carbon intensity floor.

In carrying out this research it will be possible to determine whether those waste management scenarios capable of achieving the carbon intensity floor and the EPS are affordable.

1.6 Research Approach

Waste Authorities in London have to date, and continue to, implement a variety of approaches for managing municipal waste dictated by specific local considerations and socioeconomic factors. This multitude of options, together with the considerable number of new and emerging waste technologies entering the market creates a large number of potential scenarios for managing municipal waste.

In order that as wide a range of scenarios as possible can be assessed SLR's approach to the project has been to develop a fully auditable excel workbook that allows an extensive range of viable waste management scenarios to be modelled and compared against each other and against the carbon intensity floor and EPS.

Each technology option is assessed using the five recycling and composting scenarios used by Eunomia to develop the EPS with differing residual waste compositions. Each of the above options is further assessed through five sub options investigating the impact of alternative methods of food waste management[11]. Scenario development and descriptions are provided in Section 2.5.1 of this report. The output results focus on providing a scenario cost, the EPS figure and if appropriate a carbon intensity floor value.

The excel workbook will become the property of the GLA on project completion and allow the GLA to update figures with new costs or technology parameters as and when they become available.

Input parameters, for example unit costs, can also be modified to allow Authority specific waste management scenarios to be modelled.

The project links closely with a secondary piece of work designed to create a "GHG Calculator tool" which will allow Authorities to model, on an ongoing basis, the performance of their waste management services against the EPS and the carbon intensity floor.

11 Wet AD with electricity generation; Dry AD with electricity generation; Wet AD with biogas to transport fuel; Wet AD with biogas injection to grid; and Aerobic Digestion.

1.7 Links with the GHG Calculator Tool

The Greenhouse Gas Calculator has been commissioned by the GLA to assist Local Authorities in assessing the greenhouse gas emissions associated with the procurement of new waste services.

The GHG Calculator has been designed to be a flexible tool which can be used in a number of situations, and assess a number of different elements of the waste stream. Users enter waste data and select options which best represent their current or proposed waste management service; the GHG Calculator processes this information and provides an estimate of the carbon dioxide equivalent emissions associated with the scenario, and determines whether the EPS and Carbon Intensity Floor are achieved. The model can be utilised to test a number of scenarios and determine the comparative performance against the EPS and Carbon Intensity Floor.

Greenhouse gas emission data utilised in the GHG Calculator has largely been obtained from the Environment Agency WRATE software, with other sources of information and calculations supplementing the WRATE data to enable an accurate GHG Calculator. The background greenhouse gas data and the approach to assessing the GHG impacts from the GHG Calculator have been utilised within this research project to determine the financial and technical implications of meeting the carbon intensity floor and EPS. It is intended that the GLA will make the greenhouse gas calculator publicly available with the release of the final MWMS for adoption in Summer 2011.

2 SCENARIO MODELLING

2.1 Methodology for Scenario Assessment

In order to satisfy the requirements of the Brief SLR has set up a Microsoft Excel based options assessment model to generate and analyse a number of potential scenarios. In total the model has the potential to analyse over 2,000 waste management scenarios which cover both existing technical practices and future scenarios based on a range of collection, pre-treatment and energy recovery solutions for recyclates, food and residual waste. The current model includes a number of spare slots for additional technologies and waste composition scenarios (for future use by the GLA).

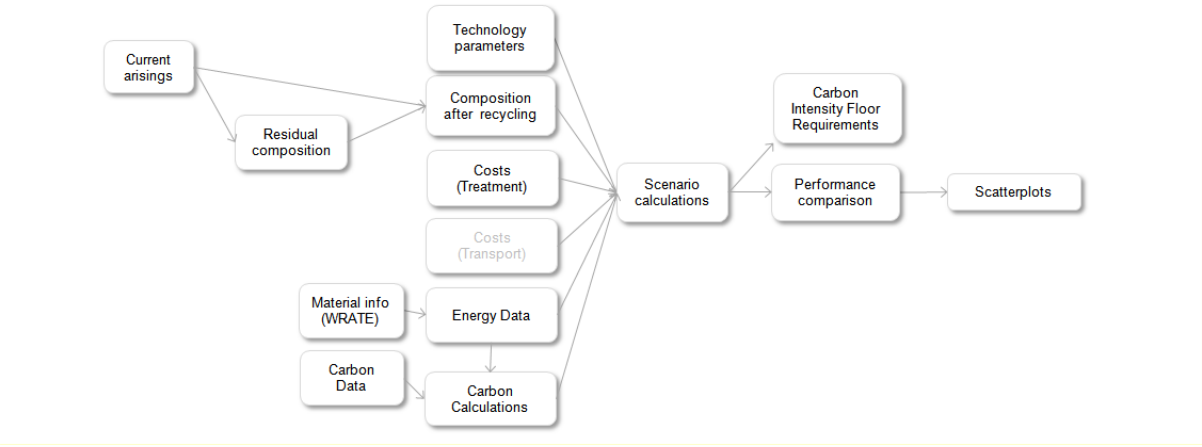
The current model, and the results presented in this report, includes 200 base waste management scenarios and assesses 5 waste composition scenarios; in total 1,000 scenarios are assessed when food waste management sub scenarios are included.

Essentially the model builds up scenarios as follows:

- Step 1 – Mass Balance & Waste Flow;
- Step 2 – Financial Model;
- Step 3 – Carbon Model; and
- Step 4 – Scenario Comparison.

The structure of the model is shown below with further details provided in Appendix A.

Figure 1: Model Structure



The model is developed as a set of interactive worksheets. A brief description of the worksheets together with screenshots is provided in Appendix A.

2.2 Technology Information

To inform the analysis contact was made with pre-treatment and energy generation waste facility operators to seek data on the proportion of materials produced for energy, recycling, rejects, water loss and other processes and to obtain information on the biomass CV content from waste treated at these facilities where available. As well as existing operators, emphasis was placed on contacting new market entrants and demonstrator facility operators to explore potential opportunities for producing high biomass fuel from waste.

To minimise the impact on recipients and thus hopefully maximise participation, data was requested in the form of existing mass and energy balances, information that should be readily available.

A list of technology providers contacted and details of the responses received is set out below:

Table 1: Results of Questionnaires

Technology Provider	Information provided	Quality of cost data	Quality of technical data
PRE-TREATMENT TECHNOLOGIES			
MHT			
Orchid	Technical and economic data provided	Data includes CAPEX, OPEX and lifecycle estimates	Technology description, mass and energy balances
Aerothermal	Process description	CAPEX but no OPEX costs	No mass or energy balance
Graphite	No data provided		
MBT			
Shanks_Ecodeco	No data provided		
New Earth Solutions	No data provided		
Clean MRF Technology			
Biffa/Greenstar	No data provided		
Bywaters	No data provided		
Alternatives			
ART	Technical and economic data provided	Typical gate fees provided	Mass and Energy balance provided
Vertal		Typical gate fees provided	
Dirty MRF Technology			
OKLM	No data provided		
THERMAL TECHNOLOGIES			
Incineration			
Belvedere	Some technical data provided	Outline CAPEX and OPEX costs	Energy generation information provided
SELCHP	Some technical data provided	Typical gate fees provided	Mass and Energy balance provided
True Pyrolysis			
Pyromex	Technical and economic data provided	CAPEX and typical gate fees	Technology description, mass and energy balances
Rentech-Silvagas			
First London Power	No data provided		
KTI/EPI (Crest Nicholson)	No data provided		

Technology Provider	Information provided	Quality of cost data	Quality of technical data
Plasma Gasification			
Advanced Plasma Power	Technical and economic data provided	Data includes CAPEX, OPEX and lifecycle estimates	Technology description, mass and energy balances
Gasification			
Energos	Technical and economic data provided	Data includes CAPEX, OPEX and lifecycle estimates	Technology description, mass and energy balances
Ethos	No data provided		
Novera- Enerkem technology	No data provided		
Cyclamax – Waste 2 Energy	No data provided		
Gasification with gas engines			
ITI Energy	Technical and economic data provided	Data includes CAPEX, OPEX and lifecycle estimates	Technology description, mass and energy balances

Brief descriptions of some of the technologies are set out in sections 2.3 and 2.4.

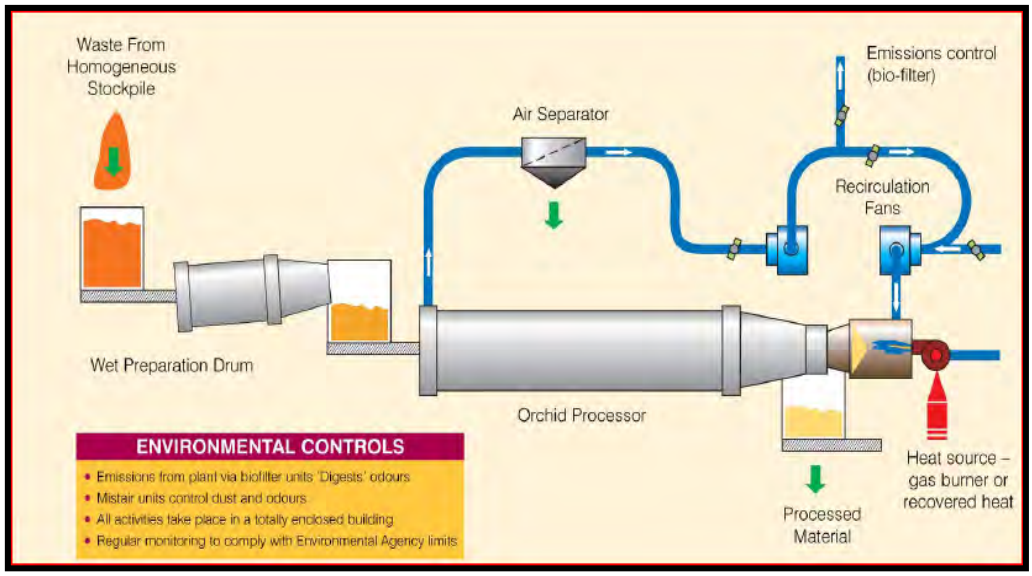
2.3 Pre-treatment Technology Details

2.3.1 Orchid Environmental

The Orchid process is defined as Mechanical Heat Treatment (MHT) where the waste materials undergo various mechanical processes and a heating element which separates, dries and sanitises the waste to produce a range of outputs, mainly recyclables and Solid Recovered Fuel (SRF).

The technology is a fuel preparation plant, and therefore an integrated part of a waste management strategy rather than an end solution. The benefit of the technology is the ability to produce a range of fuel specifications that can service different markets and be used in a variety of thermal applications.

Figure 2: Schematic of Orchid Heat Treatment Process



A byproduct to this process is the recovery of recyclable material. Previously contaminated material not recovered as part of separate material collection systems is recycled into established markets as the drying process in the rotating drums facilitates the recovery process.

The technology's recycling and landfill diversion performance is dependent on the input composition, principally if it is processing Municipal Solid Waste (MSW) or Commercial & Industrial waste (non-hazardous) (C&I waste).

2.3.2 Advanced Recycling Technologies (ART) Environmental

The ART technology is an advanced process for the conversion of mixed municipal and C&I wastes into high grade fuel pellets that can be used as a substitute for conventional fuels in coal fired power stations.

A combination of conventional separation equipment, thermal drying and aerobic digestion are utilised to convert incoming waste into desired fuel products and high quality recyclates.

The ART process is capable of generating a high biomass fuel with gross CV in the range 13-17 MJ/kg and biomass content in excess of 90% by GCV, subject to final OFGEM approval. A further issue being considered by ART is whether the generated fuels can be potentially removed from waste regulation control.

2.3.3 Mechanical Biological Treatment

A number of technology providers were invited to submit information on their MBT processes although no invitee responded. MBT is a well understood process and therefore data has been extracted from SLR's databases.

MBT technologies operate in two potential configurations:

- Biostabilisation mode, in which the entire waste stream is biologically treated over extended time periods to achieve maximum reduction in the biodegradability of the waste, with the resulting organic product sent direct to landfill;

- Biodrying mode, in which a combination of biological drying and mechanical separation techniques are used to recover recyclables and a high calorific value fuel.

Both forms of technology are included in the model in order to assess the benefit of fuel production and combustion against landfill.

2.4 Thermal Technologies

Thermal technologies for the conversion of waste to energy can be categorised under the three generic headings of incineration, gasification and pyrolysis covering the full range of combustion processes. Incineration or 'mass burn' technologies have been utilised in Europe and the UK for many years, and are considered to be fully bankable technologies with a number of commercial facilities operating in and around London.

Non-combustion technologies, referred to as Advanced Thermal Treatment (ATT) or Advanced Thermal Conversion (ACT), can broken down into the following generic types:

i. Gasification (Two stage combustion; waste heat recovery only, generating steam for energy production from steam turbines);
ii. Gasification (syngas generating technologies; with energy production from direct gas engines);
iii. Pyrolysis; and
iv. Plasma Arc Technology.

Recent development in each of these areas has been rapid over the past few years with a number of companies now offering commercially viable facilities. Others are still in developmental stages and are less well documented or yet to be proven in commercial operations.

These thermal processes involve the breakdown of combustible materials using a combination of heat, time and an environment with low or complete absence of oxygen.

Gasification and pyrolysis processes are intermediary stages in the thermal degradation process, characterised by the production of high calorific value fuels which are subsequently processed to recover energy through a range of possible energy conversion technologies, for example steam turbines or gas engines.

2.4.1 Incineration

There are a number of incinerators, designed to take untreated residual MSW operating in or close to London. All of these facilities utilise moving grate combustion and generate electricity via steam turbines.

The newest of London's incineration facilities is the Riverside Resource Recovery Facility, a Energy from Waste facility at Belvedere with an average annual capacity of 585,000 tonnes and a net energy efficiency of 27%.

2.4.2 Gasification

Gasification can be defined as the partial thermal degradation of a substance in the presence of insufficient oxygen to oxidise the fuel completely. The resultant synthetic gases (syngas) produced through such a process are typified by a combination of oxides of carbon (both carbon monoxide and carbon dioxide), methane, water and hydrogen, with trace amounts of higher hydrocarbons.

A typical gasification process will largely avoid the formation of higher hydrocarbons through control of temperature and extent of oxygen addition to the process. The avoidance of these hydrocarbons reduces the issues associated with tars and oils formation and detrimental impacts on downstream processes.

The quality of gas anticipated and the fine controls required to manage gas quality has led to the emergence of two further classifications for gasification processes as staged combustion or gas generating technologies.

Staged Combustion Technologies

In this type of process the feedstock is gasified in a primary chamber and the generated gas is immediately subjected to additional air on passing into a secondary combustion zone.

In such processes the heat energy created through the gasification and final oxidation phases is captured through a waste heat recovery unit to create steam.

The steam can subsequently be utilised for a combination of steam turbine generated electrical energy and/or community heating projects. Such processes are typically closely aligned with mass burn incineration technologies utilising moving grate technologies within primary chambers.

Gas Generating Technologies

In this type of process the feedstock is gasified to generate a consistent and comparatively high quality syngas. The syngas is typically cooled and 'cleaned' through a range of gas scrubbing techniques to remove excess water, oils/tars, particulates and other contaminants. The cooled and cleaned syngas is then capable of being piped as a fuel to electrical generating plant, such as gas engines, or possibly gas turbines, depending on the quality control and calorific value of the syngas.

Typically, gas generating technologies require a highly processed consistent fuel such as SRF to maintain the generation of a reasonable calorific value syngas. These processes may typically demand a feedstock of a lower moisture content, higher calorific value and smaller particle size than is necessary for the staged combustion type processes. Typical moisture levels in the SRF for syngas production can be as low as 3%, rising to typically 8-10% as a maximum.

2.4.3 Pyrolysis

Pyrolysis is defined as the partial thermal degradation of a substance in the absence of oxygen and produces a combination of synthetic fuels comprising of gas, oils and/or tars, and a solid char.

Commercial pyrolysis processes are emerging, although such facilities typically require feedstock quality similar to the gas generating gasification technologies. Additionally, in order to achieve true pyrolysis conditions in the absence of air or other oxidising agents there is a need for strict and careful control of feeding mechanisms and often, a finely sized feedstock.

Further difficulties can arise due to the generation of a wide range of sticky tars/oils that can create significant problems, in particular due to feedstock variability.

It is more typical to find pyrolysis employed in combination with other thermal technologies into an integrated process. Such pyrolysis-gasification processes include applications where an initial high temperature phase is used to initiate degradation of the feedstock with little or

no air/oxidising agent and the resulting products pass immediately through to a more conventional gasification phase. Secondary processes may be conventional combustion schemes with indirect heating in a pyrolysis phase or plasma technology applications.

2.4.4 Plasma Arc Gasification

Plasma arc technology has been in use in commercial applications for a number of years and is currently being introduced as an application relating to waste disposal and/or treatment. Plasma arc technology is not generally used as the sole means for processing waste materials, as this would require very high levels of energy without comparable benefits. However, plasma arc technology can be utilised in combination with other waste gasification/combustion technologies to provide an alternative solution for the thermal treatment of waste.

A plasma arc utilises high voltage, high current electrical energy passing through two electrodes to generate extremely high temperatures within the arc column created. At the high temperatures hydrocarbon materials are decomposed to an elemental level in the presence of oxygen and in some instances, steam. Inert materials become molten and on cooling form an inert slag-type material, sometimes known as vitrified slag when in the presence of silica or sand. This glassy product tends to be inert and non-leaching and can be re-used in road construction and/or as a building material.

The hydrocarbon elements, including hydrogen, carbon and oxygen, re-combine downstream of the extreme temperatures and form typical combustion products depending on the ultimate process conditions.

Details of technologies classified as advanced thermal treatment are given below:

2.4.5 ITI Energy

ITI Energy Limited has developed a patented advanced gasifier that combines the benefits of both down-draught, side-draught and up-draught gasification to produce a syngas. A major advantage of the ITI Energy gasifier is the very low level of tar and oil in the syngas, which combined with a highly effective gas clean-up system, means that it can be fed directly into internal combustion gas engines, dual-fuel diesel engines and/or existing boilers using appropriately designed burners.

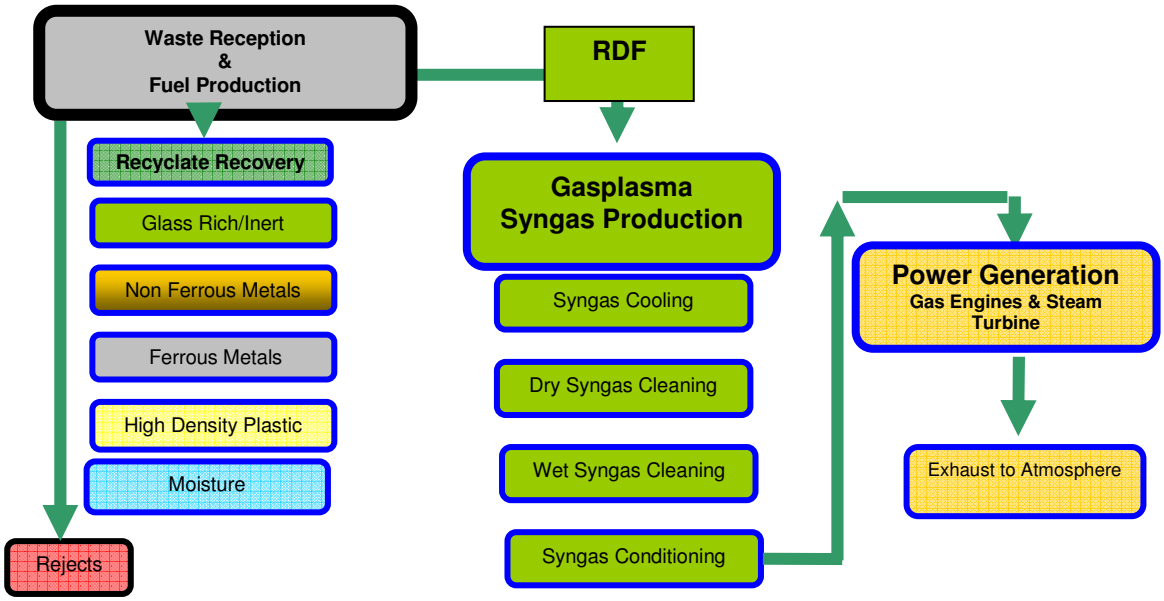
The facility is designed to take Briquetted Fibre Fuel (BFF); information from ITI does not cover the briquetting process although a specification for the BFF is provided.

2.4.6 Advanced Plasma Power (APP)

The technology offered by Advanced Plasma Power Ltd (APP) utilises a combination of conventional fluid bed gasification with a well established plasma arc treatment technology. This combination solves the technical problems of conventional gasification by producing a clean, hydrogen-rich syngas capable of being used by standard gas engines to generate a higher power output compared with that derived from conventional steam turbine systems. The process simultaneously vitrifies all the chars and ash into a recyclable product and radically reduces the processing costs that can be associated with direct plasma gasification.

The APP proposed Gasplasma plant can potentially operate at a local scale processing around 100,000-150,000 tonnes of waste per annum through an integrated facility of SRF preparation and gasification.

Figure 3: APP Flow Diagram



2.4.7 Pyromex

The Pyromex technology utilises a high temperature pyrolysis process operating at temperatures up to 1700°C. At this high temperature the problems that beset standard pyrolysis technologies, such as tar creation, are avoided. The technology therefore produces a higher CV and higher quality syngas than competing technologies. Once generated the syngas is cleaned before use in a gas engine generator.

2.4.8 Energos

The technology offered by Energos is a staged combustion technology, with steam heat recovery and power generation using a steam turbine.

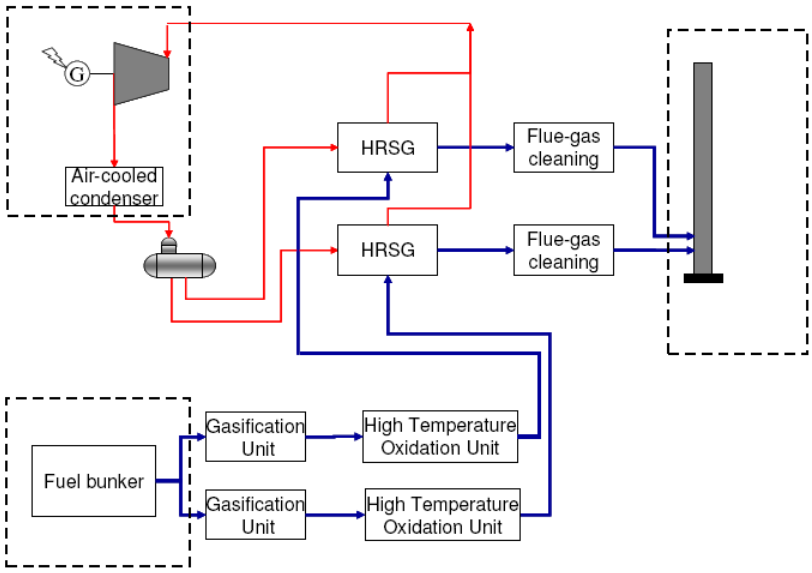
The staged combustion process involves an initial or primary combustion chamber into which the feedstock is introduced and through which air is passed to partially combust the materials, similar to a conventional grate combustion process but with restricted air flow. In parallel, the gases generated by combustion of the solids have insufficient air to enable complete combustion and hence a relatively 'weak' synthetic gas is generated. The syngas generated is then immediately passed to a secondary combustion chamber, in which surplus air is introduced to allow complete combustion of the syngas.

The process generates a residual bottom ash as a consequence of the solids combustion and the flue gases subjected to conventional scrubbing techniques downstream of the waste heat recovery boiler, similar to mass burn technologies.

The process technology is almost identical to a mass burn process, with the exception of the staged introduction of air, to enable classification of the process as gasification and allow the syngas generated to potentially qualify for ROCs. The process is suitable for a broad range of relatively low quality SRF-type feedstocks and requires a slow burning material to maintain adequate control through the primary chamber and across the moving grate.

Figure 4 shows an outline block flow diagram for the Energos process.

Figure 4: Outline Flow Diagram for an Energos Gasification facility



2.4.9 General Technology Details

In addition to the above technologies, SLR has incorporated details of other specific pyrolysis and gasification technologies into the model, although the names of technology suppliers have not been included to avoid confidentiality issues.

2.5 Mass Balance and Waste Flows

2.5.1 Waste Arisings and Waste Composition

Mass balances and waste flows have been developed which trace the movement of all waste components from point of generation to point of final recovery or disposal. These mass balances are based on total waste flows for London, although there is no reason why authority specific scenarios could not be developed in future iterations of the model.

The basis of the model is the current waste management performance across London as reported in Table 2.

Table 2: London Waste Arisings (2009/10)[12]

Method	London		
	2007/08	2008/09	2009/10
Landfill	2,209	1,946	1,523
(percentage)	53%	*49%*	*40%*
Incineration with EfW	919	912	629
(percentage)	*22%*	*23%*	*16%*
Incineration without EfW	0	0	0
(percentage)	0%	*0%*	*0%*
Recycled/composted	925	994	1,061
(percentage)	*22%*	*25%*	*28%*
Other	101	123	613
(percentage)	*2%*	*3%*	*16%*
Total	**4,154**	**3,975**	**3,826**

The technology options modelled are summarised in Table 3, each technology option was modelled with 5 recycling and composting scenarios (described below). In addition each technology was assessed with 5 sub scenarios investigating differing methods of food waste management. The technologies producing an SRF had a further range of fuel use sub scenarios modelled (Incineration, ATT, Cement Kiln, Power Station). The combination of the technology scenarios and sub scenarios results in a considerable number of technical scenarios being assessed against the current EPS and Carbon Intensity Floor level. The study thus represents a robust and comprehensive assessment of the technical and financial implications of achieving the EPS and carbon intensity floor.

12 Defra UK waste statistics 2009/10 www.defra.gov.uk

Table 3: Technology Scenarios Available within the Model

Technology Type								
MHT	**MBT aerobic**	**MBT biostabilisation**	**MBT AD**	**Incineration**	**Gasification**	**Gasification with gas engines**	**True pyrolysis**	**Dirty MRF**
MHT 1	MBT aerobic 1	MBT biostab 1	MBT AD 1 (Landfill)	Incineration 1 (electricity only)	Gasification 1	Gasification Gas Engine 1	True Pyrolysis 1	Dirty MRF 1
MHT 2*	MBT aerobic 2 (Landfill)	MBT biostab 2 (Spare)	MBT AD 2 (SRF)	Incineration 2 (low CHP)	Gasification 2	Gasification Gas Engine 2	True Pyrolysis 2 (Spare)	Dirty MRF 2 (Spare)
MHT 3 (Spare)	MBT aerobic 3		MBT AD 3 (Spare)	Incineration 3 (medium CHP)	Gasification 3 (Spare)	Gasification Gas Engine 3 (Spare)	True Pyrolysis 3 (Spare)	
	MBT aerobic 4*			Incineration 4 (high CHP)	Gasification 4 (Spare)			
	MBT aerobic 5 (Spare)			Incineration 5 (medium efficiency electricity)				

Note:* These technologies are capable of producing a high biomass SRF.

The project builds on the work previously undertaken by Eunomia and considers five possible levels of recycling and composting options as follows:

- NC i.e. “No change”: Do Nothing New (based on London’s 2008/09 waste management performance including 25 per cent recycling and composting performance)[13];
- Lo: 25 per cent recycling and composting rate, concentrating on dry recyclables only;
- Mid-d: Focus on dry recycling without food waste collections achieving 45 per cent recycling rate;
- Mid-f: Focus on food collection achieving 45 per cent recycling and composting performance through a combination of mixed dry and food collections;

13 Waste tonnages have been updated to 2009/10 tonnages

- Hi: Max GHG abatement achieving 60 per cent recycling and composting rate with particular emphasis on food waste collection.

The corresponding compositions of residual waste assumed from the five recycling and composting options are summarised in Table 4.

Table 4: Residual Waste Compositions following different Recycling Efforts

Primary Category	NC	lo	mid -d	mid -f	hi
Paper	16%	12%	6%	9%	6%
Card	8%	8%	6%	7%	6%
Plastic Film	4%	5%	7%	7%	10%
Dense Plastic	6%	7%	4%	8%	8%
Textiles	3%	4%	4%	4%	5%
Misc. Combustible	9%	11%	13%	13%	18%
Misc. Non-combustible	6%	5%	6%	6%	8%
Glass	5%	4%	4%	5%	5%
Ferrous	5%	6%	4%	5%	5%
Non-ferrous	1%	1%	1%	1%	1%
Garden waste	11%	7%	2%	3%	2%
Kitchen waste	24%	29%	43%	32%	26%
fines	2%	1%	2%	2%	2%

2.6 Financial Modelling

2.6.1 Technology and Cost Data

In assimilating technology data, cost information was also requested from facility operators and technology providers, however there was a general reticence to provide accurate information.

Where technology data or cost information was not provided relevant data was extracted from SLR technical databases.

2.6.2 Inclusion of Cost Data

The cost model has been designed to be fully inclusive and seeks to include all forms of waste management activities from waste collection to transfer stations for the receipt and bulking of wastes to mechanical biological treatment for preparation of waste derived fuels through to final energy conversion.

With respect to the treatment facility costs, the assessment and results are presented using three approaches:

- Gate fee basis:
- Gross annualised Capex and Opex facility data (excludes incomes from electricity and ROCs), or
- Net annualised Capex and Opex facility data (includes incomes from electricity and ROCs).

Table 5 sets out the cost data that has been included in the model. In some circumstances only gate fee data is available whilst for others both gate fee and facility data are included in the model.

Table 5: Cost modelling – Source of Cost Data

	Gate fees	Technology Unit Costs
Waste collection		
Kerbside sort	Mayor's Draft MWMS	
Commingled Recyclate	Mayor's Draft MWMS	
Food waste collections	Steering Group	
Green waste collections	SLR	
Residual collections	Mayor's Draft MWMS	
Recycling and Transfer Stations		
CA sites	SLR	
Bring banks	SLR	
MRFs	WRAP	
Transfer stations	WRAP	
Organic wastes		
Green waste composting	WRAP	
Anaerobic digestion	WRAP	SLR database
Biogas upgrade & injection to gas grid		SLR database
Biogas upgrade & vehicle fuel		SLR database
Aerobic digestion	LB Lambeth Council	
Waste treatment		
Dirty MRFs		SLR database
MBT (aerobic)	WRAP	SLR database
MBT (anaerobic)		SLR database
Mechanical heat treatment		Tech provider
Energy recovery		
Incineration	WRAP	SLR database
District Heating		Published Report
Gasification		Tech provider
Gasification with gas engines		Tech provider
True pyrolysis		Tech provider
Plasma gasification		Tech provider

The approach for calculating annualised Capex and Opex unit costs is described in Section 2.6.3.

Waste collection costs and facilities managing recyclables are not subject to the Capex and Opex approach. In these cases a unit fee (£/t collected or managed) is utilised. The treatment of residual waste and food waste is assessed by the Capex and Opex approach in addition to use of standard gate fee data.

Appendix C, D, and E include scenario summaries which contain total cost data and a breakdown (£/t) for waste collection and waste disposal.

2.6.3 Methodology for Determining Unit Technology Costs

Where unit residual treatment technology costs (gross and net) have been supplied by technology providers in the form of CAPEX and OPEX costs it has been necessary to develop a per tonne cost metric that reflects the cost of receiving and processing municipal waste. Table 6 indicates the methodology that has been used to convert input data from technology providers into a per tonne cost estimate. A similar philosophy has been used for information derived from SLR databases. Certain cost elements, for example management of waste outputs are excluded from the cost metric as these are derived within the mass balance model.

Table 6: Methodology for Deriving Unit Technology Costs

Cost Element	Method
Capex costs	
M&E Capex cost	Supplied by tech provider
Civil Capex Cost	Supplied by tech provider
Cost of capital	Calculated by SLR (7% over 15 years)
Site purchase	Nominal fee between £2 million and £5 million added
EPC costs	Added at 7% of M&E and Civil costs
Peripherals	Added at 10% of M&E and Civil costs
Opex cost	
Manning	Included in OPEX
Consumables	Included in OPEX
Lifecycle replacement cost	5% of M&E
Insurances	1% of M&E and Civil Costs
Waste management fees	
Ash disposal	Average figure for fly ash and bottom ash disposal applied
Recyclables	Determined from mass balance with average incomes/costs applied
Landfill outputs	Determined from mass balance with average costs applied

M&E: Mechanical and Electrical including installation
EPC: Engineering Prime Contractor costs associated with management of the facility construction and project delivery

2.6.4 Gate Fee Information

Gate fee information has been drawn from three different data sources:

- WRAP Gate Fees Report;
- SLR Internal Databases;
- Pay as You Throw rates submitted by Western Riverside Waste Authority.

The model includes data extracted from the most recent WRAP report on waste treatment gate fees, an extract of which is given in Table 7[14]. The data in the report is derived from a survey of facilities in England, Wales, Scotland and Northern Ireland conducted during February/March 2010. The survey covered both those procuring waste treatment, disposal and recovery services (primarily local authorities) and service providers, including interviews with senior managers in waste management companies (WMCs). In addition, Defra information on facilities in PFI/PPP planning and other market intelligence is incorporated into the report.

Table 7: Summary Information on Gate Fees (WRAP Data)

Treatment	Grade/material/type of facility	Median	Range
MRF	Paper/card/plastic bottles/cans	£33	-£5 to £42
Composting	Open-air windrow (OAW)	£24	£11 to £51
	In vessel (IV)[1]	£45	£26 to £104
AD	Anaerobic digestion (AD)	£57	£50 to £90
Landfill	Gate fee only[2]	£22	£11 to £44
	Gate fee plus Landfill tax[3]	£70[#]	£59 to £92
Incineration	Existing facilities[4]	£49	£32 to £79
	Planned facilities[5]	£92	£78 to £109
	Current market estimate[6]	-	£85 to £120
MBT[7]		£75	-

[1] Mixed food and green/garden waste. [2] This is a UK wide figure; Regional estimates appear elsewhere in the report. [3] The standard rate of landfill tax increased to £56 per tonne on 1 April 2011. [4] Facilities used by local authorities surveyed. Feedback from WMCs indicates that these may not be a reliable estimate of gate fees in the current market. 5 Based on a capacity of between 200kt and 300kt from Defra information on facilities currently in procurement via PPP/PFI. Refer to the text in the report for information on other capacity ranges and gate fees. [6] Industry estimate through feedback from WMCs surveyed who provided an indicative range. [7] Insufficient data points for a range.# The landfill gate fee has been increased in the modelling to take account of landfill tax rate in 2014 and beyond (£80 per tonne).

SLR maintains a database of gate fees drawn from a number of sources. In the majority of cases the data represents spot prices for acceptance of commercial waste. As a consequence the gate fees quoted are likely to be lower than those quoted for municipal waste. Where possible the model seeks to use London specific data.

Table 8: Summary Information on Gate Fees (SLR Data)

Treatment	Low	High	Median
AD	£31	£42	£37
IVC	£47	£56	£52
MHT	£57	£83	£70
Incineration	£73	£83	£78
MBT	£62	£67	£65

14 Gate Fees Report 2010. Comparing the cost of alternative waste treatment options, WRAP

In developing the project, members of the Steering Group were asked to submit relevant cost data for incorporation into the study and/or for comparison against assumptions and costs from other sources.

Due mainly to confidentiality issues many of the Steering Group members were unable to submit data. Information was however received from West London Waste Authority and this is replicated below.

The information in Table 9 represents the Authority's Pay as You Throw (PAYT) rates for 2011/12. These are the rates that the Authority charges the boroughs for the disposal service that they require. They are not gate fees, as they represent averaged costs where more than one provider is used. They include for some transport costs, (which are dependent upon the location of the plant), but do not include any Transfer Station operating costs or Authority overheads.

Table 9: Summary Information on PAYT Rates

Waste Treatment Method	PAYT Rate 2011-12 (£ per tonne)
Waste to Landfill	85
Incineration	97
Dirty MRF (including transport)	86
Windrow Composting	36
In-Vessel Composting	36
Anaerobic Digestion	60

Gate fee and PAYT data is compiled for comparison purposes in Table 10.

Table 10: Comparison of Gate Fee and PAYT Rates (Median Estimates)

Waste Treatment Method	PAYT Rate	SLR Data	WRAP Data	Chosen Data
Waste to Landfill	85		70	WRAP
Incineration	97	78	49 (existing) 92 (planned)	WRAP
Dirty MRF (including transport)	86			PAYT
Windrow Composting	36		24	WRAP
In-Vessel Composting	36	52	45	WRAP
Anaerobic Digestion	60	37	57	WRAP
MBT		65	75	WRAP
MHT		70		WRAP

In all cases the WRAP data has been used as it represents the most comprehensive data set available for municipal waste contracts whereas the SLR dataset is based on spot market prices. It is recognised that the chosen dataset may not be fully representative of all Authorities in London.

Cost figures for source separated materials and commingled materials are included for the recyclables stream (Table 11). These figures are in line with earlier costs published in Mayor's Draft MWMS.

Table 11: Gate Fees for Recyclable Materials

Waste Treatment Method	Gate Fee (£/t)
Source segregated recyclables (incl kerbside, HWRC and Bring)	-54
Commingled recyclables (to MRF)	32

Source: Mayor's Draft MWMS

A breakdown of how the source separated gate fee price has been derived is presented in Table 12.

Table 12: Calculation for Source Seperated Recyclable Gate Fee

Material Type	Typical tonnage split (%)	Chosen cost (£/t)
Paper	42%	**-85**
Card	9%	**-105**
Plastic Film	3%	**-85**
Dense Plastic	4%	**-215**
Textiles	3%	**-240**
Misc. Combustible	7%	**20**
Misc. Non-combustible	7%	**20**
Glass	12%	**-17**
Ferrous	9%	**-137**
Non-ferrous	1%	**-920**
Kitchen waste	0%	**50**
Garden waste	0%	**0**
Fines	1%	**20**
blank	0%	**0**
blank	0%	**0**
Average costs for segregated recycling	-	**-84**
Handling Fee (per t)		**30.0**
Net Gate Fee (per t)		**-54**

2.6.5 Methodology for Determining Collection Costs

Cost figures associated with kerbside waste collection have been derived from the Mayor's Draft MWMS, other collection costs (for example bring sites and Household Waste Recycling Centres) have been included based on judgement with respect to relative costs against the quoted kerbside collection costs. Assumed waste collection costs are presented in Table 13.

Table 13: Collection Cost Assumptions (£/t)

Waste Collection Method	Recycling	Food Waste	Green waste	Residual Waste
Kerbside	122* - SS 77* - Commingled	324#	90*	64*
HWRC	40	-	40	40
Bring Site	50	-	-	-
Other	40	-	15	64

*: Mayor's Draft MWMS
#: Steering Group data
SS: Source segregated

2.7 Carbon Modelling

2.7.1 Carbon Intensity Floor

In order to calculate performance against the carbon intensity floor it has been necessary to adopt a methodology to determine the carbon impacts of any waste destined for energy generation within the waste management scenarios modelled. The purpose of the carbon analysis is to compare the performance of the modelled scenarios against:

a. how London performs against the carbon intensity floor (using Defra guidance on the marginal source of electricity (CCGT); and
b. how the waste scenarios modelled would perform against DECC-approved grid mix carbon intensity projected to 2025 (as a sensitivity).

In calculating the Carbon Intensity performance for each scenario the following equation has been utilised:

$$\text{Carbon Intensity (gCO2e/kWh)} = \frac{\text{Direct emissions associated with energy generating treatment technologies (gCO}_2\text{)}}{\text{Gross electricity and heat generated by the technologies (kWh}}$$

The following approach has been used to derive the carbon intensity calculation:

Numerator

The direct emissions associated with generation of electricity and heat from waste management activities has been calculated as follows:

Residual technologies	sum of the fossil carbon contents of each component of the waste stream multiplied by a factor to convert to carbon dioxide emissions and multiplied by a GHG factor derived from WRATE to account for non CO_2 greenhouse gas components;
Organic energy generating technologies	based on the direct burden emissions (per tonne input) determined from WRATE modelling

Denominator

The electricity and heat generated from the facilities is calculated as follows:

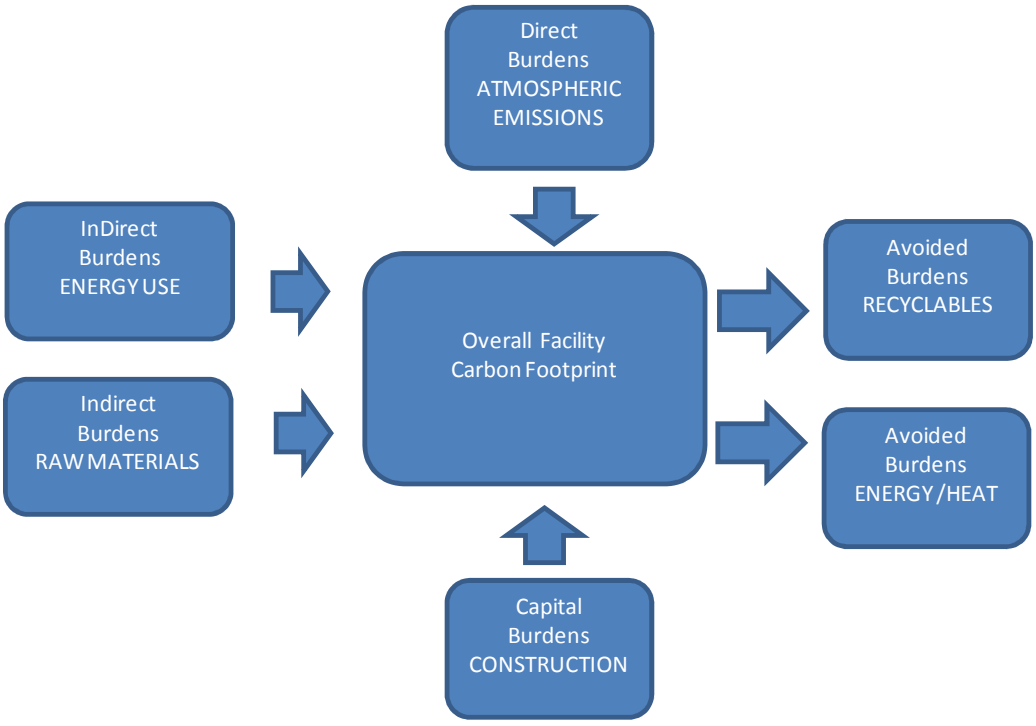
Residual technologies	Calorific value of the waste/SRF multiplied by a technology specific energy efficiency factor;
Organic energy generating technologies	Input tonnage multiplied by a Biogas generation factor and energy content factor multiplied by a technology specific energy efficiency factor

2.7.2 Environmental Performance Standard

Consideration was given to using WRATE to conduct the carbon analysis to determine performance against the EPS. However given the number of scenarios that are being considered this approach has not been progressed. Instead a simplified methodology has been adopted based on key carbon metrics derived in WRATE for key processes and material outputs. As such it is possible to determine the carbon performance of all modelled scenarios.

The methodology, which mirrors the approach being adopted in the GHG Calculator tool for the EPS calculations, is described below (Figure 5):

Figure 5: Elements Incorporated into a Facility Carbon Footprint for EPS



Note: the capital burdens of all facilities (existing and new) are divided by the capacity and operational lifetime of the facility to generate a per tonne impact which is attributed to each tonne of waste managed through the facility. This is comparable to the methodology used in WRATE to derive capital burdens.

Methodology for calculating Carbon Footprints for EPS	
Atmospheric Emissions	Direct CO2 emissions computed from the carbon content of the waste. Emissions of other GHGs (CH4, N2O) will be determined from WRATE by calculating a total GHG:CO2 factor. The GHG:CO2 factor is applied to calculated CO2 emissions to determine total GHGs (CO2e)
Indirect Burdens (Raw Materials)	Derived from WRATE and assigned on a per tonne basis.
Capital Burdens (Construction)	Derived from WRATE and assigned on a per tonne basis.
Indirect Burdens (Energy Use)	An energy use value per tonne is derived from WRATE. Grid relevant factors applied to derive carbon benefits.
Avoided Burdens (Recyclables)	Benefit is assigned on a per tonne basis for individual materials. Choice of datasets e.g. WRATE or DEFRA/DECC.
Avoided Burdens (Energy/Heat)	Waste calorific value will be derived from waste composition. Energy efficiency factors applied to derive energy outputs. Grid relevant factors applied to derive carbon benefits.

The model includes the cost of waste transport activities but does not calculate the carbon impact associated with transport of waste in line with the EPS methodology as proposed in the Mayor's draft MWMS, although the ability to do so at a later date is included. In SLR's previous experience, the impacts of transportation (when assessing a full MSW solution) are relatively minor in comparison to the impacts associated with the recycling and residual treatment processes. The latest EPS report by Eunomia concludes that the total emissions associated with meeting the EPS for London in 2031 is -1,029.8 $ktCO_2e$, transportation contributes 43.9 $ktCO_2e$ to the total figure, thus demonstrating a small overall impact relative to the emissions associated with reprocessing and treatment of materials.

3 MODELLING RESULTS

3.1 Comparative Costs of Energy Generation Technologies

Using technical data from technology providers it is possible to compare the Capex and unit costs of different forms of energy generation as indicated in Table 14. The net annual cost per tonne represents the annualised Capex and Opex costs and includes income from energy generation, including ROCS income, as well as the cost of pre-treatment in the case of gasification with gas engines.

Table 14: Comparative Costs of Energy Generating Technologies

	Capex per tonne	Net annual cost per tonne
Incineration (200ktpa)	£ 830	£ 82
Incineration (300ktpa)	£ 670	£ 58
Incineration (670ktpa)	£ 520	£ 37
Staged combustion (96 ktpa)	£ 540	£ 64
Gasification with engines (45 ktpa)	£ 560	£ 51
True pyrolysis (75 ktpa)	£ 450	£ 61
Plasma gasification (150 ktpa)	£ 520	£ 41

Table 14 indicates that there is no clear winner with respect to costs for energy generation technologies. The 200 ktpa Incineration is relatively expensive on all three cost metrics however the two larger scale Incineration plant deliver comparable cost performance to the advanced conversion technologies. It is important to note that the capital costs are based on different scale of facilities and therefore direct comparison of capital costs on a per tonne basis will not be truly accurate.

3.2 Comparative Technical Factors for Thermal Treatment technologies

There are a range of factors that impact on the commercial viability of energy generating technologies; two important factors are net energy efficiency and unit capacity. The former factor identifies the quantity of input calorific value that is ultimately converted into grid exportable electricity and usable heat whilst the latter defines the plant throughput and the number of units required to satisfy a given treatment capacity.

Table 15 indicates marginal differences between the net electrical energy efficiencies of the different technologies with the large scale Incinerator delivering the highest electrical energy efficiency.

Table 15: Net Energy Efficiency of Example Energy Generating Technologies

	Net energy efficiency
Incineration (200ktpa)	23%
Incineration (300ktpa)	23%
Incineration (670ktpa)	27%
Staged combustion	17%
Gasification with engines	27%
True pyrolysis	23%
Plasma gasification	23%

As one would expect for modular type technologies Table 16 indicates that the ACT technologies would require a significant number of units to match the combined processing capacity of a large scale incineration facility.

Table 16: Module Capacities for Energy Generating Technologies

	Typical Capacity per module (ktpa)	Number of equivalent units[1]
Incineration (200ktpa)	200	3.25
Incineration (300ktpa)	150	4.5
Incineration (670ktpa)	225	3
Staged combustion	48	14
Gasification with engines	10	68
True pyrolysis	25	27
Plasma gasification	50	14

1. Technology for comparison taken to be the Riverside Resource Recovery Facility

Modularity infers a greater number of lower capacity plants made up of singular or multiple units. Whilst this increases the overall numbers of facilities required this situation can yield benefits for integration into district heating networks.

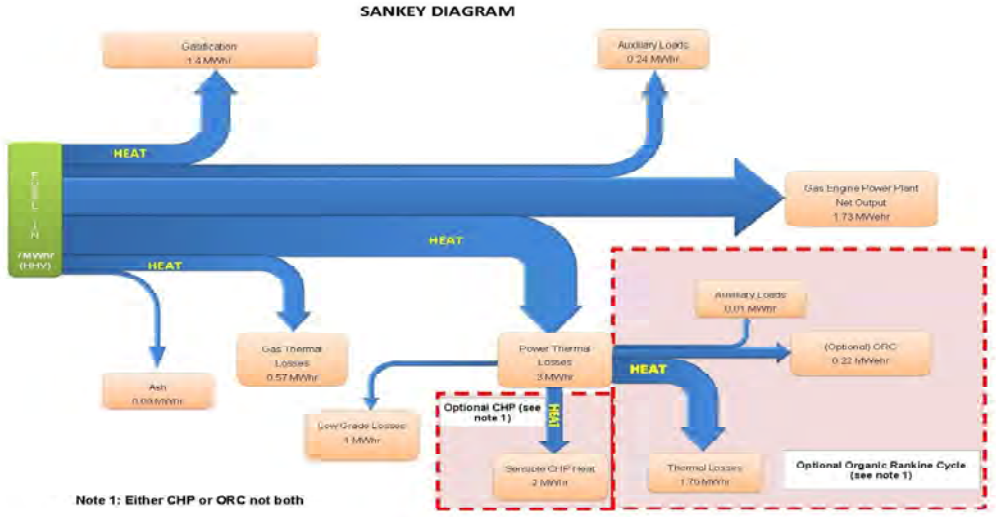
3.3 Combined Heat and Power

3.3.1 ACT technologies

A number of the ACT technologies indicated the ability to generate useable heat for export (Figure 6).

For example, the Sankey diagram submitted by ITT indicates heat availability for CHP of 2MWh, based on a fuel input of 7 MWh.

Figure 6: Energy Flow Diagram for an ACT Technology



Engines and their lubricating oil must be cooled to prevent overheating. This cooling system provides heat in the form of hot water, which is produced whenever the engine is running, irrespective of whether or not it can be used. In a packaged CHP unit, the engine/lubricating oil cooling system is usually connected to a heat exchanger that can also recover heat from the engine exhaust, which helps to maximise the efficiency of energy recovery from the engine. Cooling system heat and exhaust heat are recovered in roughly equal proportions from a gas engine CHP package. The heat from the engine is typically at around 80°C, but some engines can operate using pressurised hot water, which delivers heat at up to 120°C.

3.3.2 District Heating Networks

Due to the range of factors that must be taken into consideration when planning District Heating Networks it is not easy to determine a so-called average cost for development of a District heating Network (DHN). However, data is available from a recent DECC report[15] which provides average DHN connection costs for different types of dwelling. These costs are replicated in Table 17:

Table 17: Indicative Costs for DHN Networks

Network Costs per dwelling: by house type	DHN infrastructure cost	DHN branch cost	HIU and heat meter	Total
Small terrace	£2,135	£1,912	£2,300	£6,347
Medium/large terrace	£2,135	£2,255	£2,300	£6,690
Semi-detached: dense	£2,719	£2,598	£2,300	£7,617
Semi-detached: less dense	£2,719	£3,198	£2,300	£8,217
Converted flat	£712	£752	£2,300	£3,764
Low rise flat	£1,500	£1,500	£2,300	£5,300
High rise flat	£1,000	£1,500	£2,300	£4,800
Average	**£1,846**	**£1,959**	**£2,300**	**£6,105**

HIU – Heat Interface Unit (heat exchanger)

15 The Potential and Costs of District Heating Networks. A report to the Department of Energy and Climate Change. Poyry April 2009

In order to establish a unit cost for a CHP network it is also important to account for operating costs and incomes. The unit costs and assumptions presented in Table 18 are used to derive a cost profile for a DHN system for a residential led development.

Table 18: DHN Network Cost Assumptions

Assumptions	Value	Reference
Opex Costs	5% of Capex	SLR Assumption
Price of heat (£/MWh)	£35	DECC
Average domestic heat consumption per annum	13.3 MWh	OFGEM (Cert 2008-2011)
Peak winter thermal load per property	5.5 kW	SLR Assumption
Renewable Heat Incentive (Large Biomass)	£26/MWh	RHI Scheme
Target IRR	6-10%	Poyry
Average take-up over scheme life	80%	SLR
Lost Energy Income (£/MWh)	£35	

An example costs assessment for a 25MWe system is set out in Table 19.

Table 19: DHN Network Cost Assessment

Heat Efficiency	10%	20%	40%
Gross Electrical Efficiency	22%	20%	16%
Average number of properties	2169	4777	11980
Capital Cost - DHN	£13,242,101	£29,165,490	£73,140,652
Net Income	-£9,904,517	-£21,814,522	-£54,706,038
Net Cost	£3,337,583	£7,350,967	£18,434,614
IRR (%)	-1.88%	-1.88%	-1.88%

Modelling of the DHN network costs indicates that a residential DHN network is unlikely to provide a positive payback over a 20 year period. If heat is costed at £60 per MWh, consistent with expectations of domestic gas price rises the IRR improves to 4.13%. Whilst these costs are only indicative they do show that the economic benefits of CHP and district heating are very fragile. This is not to say that a DHN would not be commercially viable but it is unlikely that the network would be delivered under the same finance arrangements as the thermal plant. Since the payback period is somewhat longer than would be expected for the thermal plant the DHN would need to be delivered as a long-term infrastructure investment similar to the approach adopted in Nottingham and Sheffield.

Domestic heating is not the only opportunity for heat utilisation from energy plant. Industrial and commercial users may offer a more significant and achievable heat resource than domestic heat networks. Costs of CHP connection for industrial heat users are very site specific but maybe as simple as a flow and return connection into an existing heat distribution. As such, the capital costs for an industrial linked system are likely to be lower than for those presented above.

A further consideration for DHNs connected to steam generating plant is the relationship between electrical generating efficiency and heat output. For CHP Schemes that include

fully or partially condensing (pass-out) steam turbines, power efficiency will decline as steam extraction increases for a given fuel consumption, so there is a balance between increasing heat recovery and reducing power output. The trade between heat to site and power for such Schemes is known as the Z ratio.

The Z ratio depends on a variety of factors, including the pressure and temperature of the steam supplied to site, steam turbine generating set's thermodynamic (isentropic) and mechanical efficiencies and vacuum (or pressure) maintained in the condenser.

Z ratios can be calculated based on the above data inputs or determined by plant measurements. For the purposes of this project a Z ratio of 5 has been chosen as representative of the range exhibited across different CHP schemes. Theoretical efficiencies for different size generating sets are presented in Table 20.

Table 20: Theoretical Efficiencies for CHP Operations

Heat Efficiency (MW)	Turbine Size (MW)				
	2	5	10	25	50
0%	19.6%	21.1%	22.3%	23.8%	24.9%
10.0%	17.6%	19.1%	20.3%	21.8%	22.9%
20.0%	15.6%	17.1%	18.3%	19.8%	20.9%
30.0%	13.6%	15.1%	16.3%	17.8%	18.9%
40.0%	11.6%	13.1%	14.3%	15.8%	16.9%
50.0%	9.6%	11.1%	12.3%	13.8%	14.9%

3.4 Renewable Energy Fiscal Incentives for CHP

Developers and operators of CHP system will most likely wish to attract additional fiscal benefits that recognise the renewable energy status of the CHP system. Potential fiscal benefits for CHP come in two forms:

- Renewable Obligation Certificates for exported electricity available to plants that achieve Good Quality CHP (CHPQA) status;
- Renewable Heat Incentives (RHIs) for eligible heat exported from the site.

Details of the two schemes are presented below;

3.4.1 Good Quality CHP

The CHPQA Good Quality standard is only relevant to facilities wishing to claim ROCs on exported electricity rather than on exported heat.

To be defined as Good Quality, new CHP schemes must achieve a Quality Index (QI) of 105, where QI is derived from a factored power and heat efficiency formulae. The CHPQA standard also requires a minimum 20% electricity efficiency.

There is some indication that this approach will be discontinued in the future[16].

16 RO-RHI interaction Policy options – Combined Heat and Power Association

3.4.2 Renewable Heat Incentive

A recent development that alters the fiscal benefits of CHP is the Renewable Heat Incentive (RHI) scheme. The RHI, recently launched by DECC does not require CHP schemes wishing to claim under the RHI to meet the Good Quality standard. This is because the Government believes the RHI will be a sufficient incentive to optimise generation of heat from CHP.

It is too early to tell whether the RHI will provide sufficient fiscal stimulus for widespread adoption of CHP enabled energy from waste schemes however given the low take-up so far of the ROCS approach it is considered likely that Energy from waste CHP operators will seek fiscal support through the RHIs.

3.5 Comparison of Solutions

As detailed in section 1.5, the purpose of this research is to provide an analysis of the financial and technical implications of meeting the EPS and the carbon intensity floor.

The modelling assesses the whole municipal waste system from waste collection through to final reprocessing/treatment/disposal, and includes recycling, composting and residual treatment materials.

In order that as wider range of scenarios as possible can be assessed SLR's approach to the project has been to develop a fully auditable excel workbook that allows an extensive range of viable waste management scenarios to be modelled and compared against each other and against the carbon intensity floor and EPS. This workbook is the property of the GLA, but due to commercially sensitive waste technology provider data and costs is not available for wider interrogation. The model is however fully auditable and modifications to assumptions, technology parameters and compositions can be investigated by the GLA.

In total the model has the potential to analyse over 2000 waste management scenarios which cover both existing technical practices and future scenarios based on a range of collection, pre-treatment and energy recovery solutions for recyclates, food and residual waste. The current model includes a number of spare slots for additional technologies and waste composition scenarios (for future use by the GLA).

Given the considerable number of scenarios, the results are presented in graphical form as a scatter plot. The following sub sections present the scatter plots for the carbon intensity floor and EPS respectively.

Full details of scenarios assessed are contained in Appendix C. The scenarios ranked by Carbon Intensity Floor figure are included in Appendix D, whilst Appendix E presents those scenarios that achieve the EPS in 2031.

3.5.1 Performance against the Carbon Intensity Floor

The ability to meet the carbon intensity floor is affected by three key variables:

- the energy efficiency of technology employed, for example, the efficiency of incineration or gasification and whether the technology generates electricity only or electricity and heat;
- the amount of biomass (e.g. food, green garden and paper/card materials) in the waste that is supplied to the facility, as higher levels of biomass make it easier to meet the carbon intensity floor; and,

- The carbon intensity of the energy sources being displaced.

Of the 1,000 scenarios modelled, 990 scenarios result in electricity and heat generation from residual and food waste management and thus feature on the scatter plots below. Ten scenarios do not result in a carbon intensity performance figure, and these are scenarios where food waste is treated by aerobic digestion and the residual waste treatment process does not involve any thermal processing (MBT aerobic biostabilisation and MBT with SRF to landfill.

The costs of individual scenarios and corresponding carbon intensity performance are depicted in Figure 7 to Figure 9 with the carbon floor level, and grid mix emissions in 2011 and predicted to 2025 overlain as red lines. The scatter charts show the carbon intensity on the Y-axis and the whole system cost (collection and disposal) on the X-axis for each scenario modelled. The chart presents the performance of each scenario against the current carbon intensity floor level (400gCO_2e/kWh) and also the carbon intensity of the UK electricity grid mix for 2011 (469 gCO_2e/kWh) and 2025 (362 gCO_2e/kWh) to provide further context. The grid mix figures have been obtained from the DECC Low Carbon Transition Plan[17]. Scenarios that fall below the red lines exceed the carbon intensity floor; conversely scenarios above the red line fail to achieve the carbon intensity floor.

17 http://www.decc.gov.uk/assets/decc/White%20Papers/UK%20Low%20Carbon%20Transition%20Plan%20WP09/1_20090724153238_e_@@_lowcarbontransitionplan.pdf

Figure 7: Carbon Intensity Floor versus Gross Capex/Opex Costs

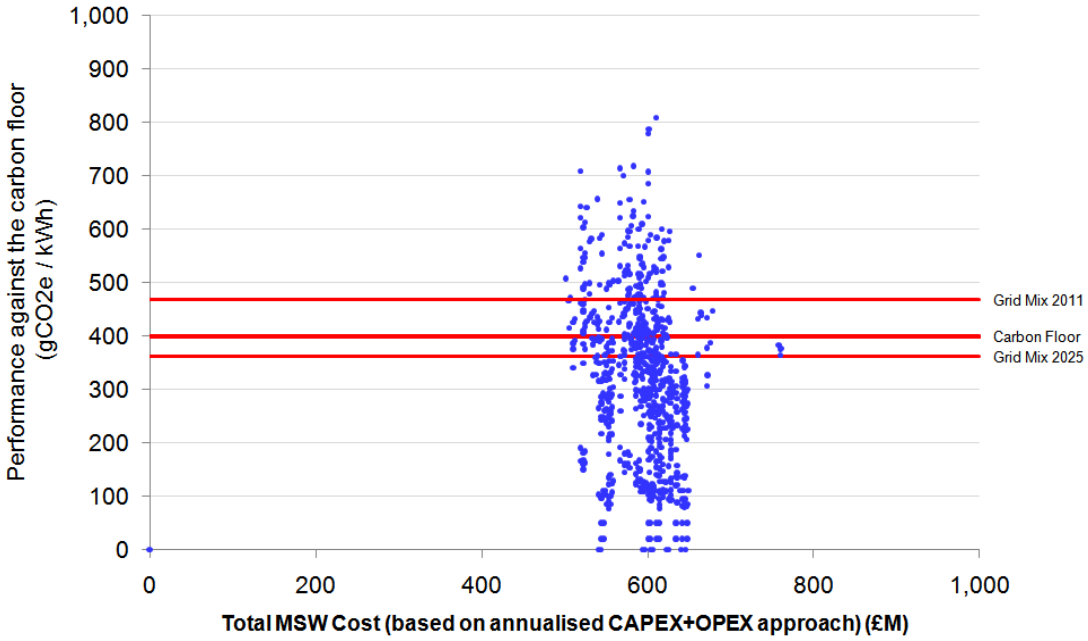


Figure 8: Carbon Intensity Floor versus Net Capex/Opex Costs

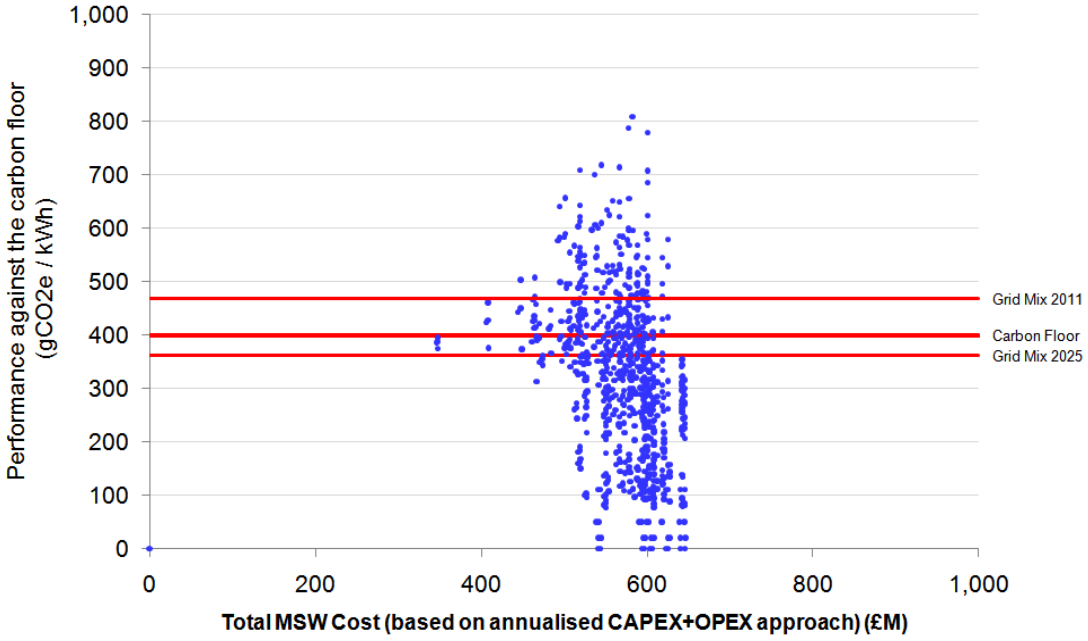
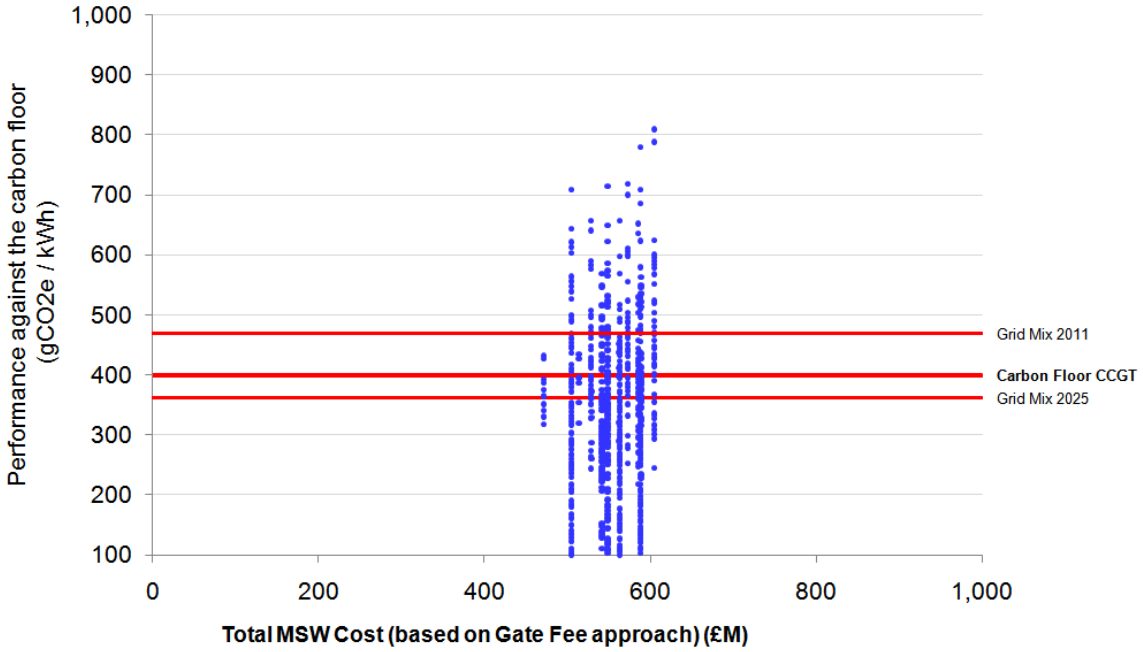


Figure 9 which plots the carbon intensity floor against the gate fee prices shows a more linear distribution; this is due to less differentiation in gate fees within each technology type as opposed to the Capex/Opex costs calculated for individual technology providers. The different cost ranges are presented to allow the user to see the variation in cost of achieving the carbon intensity floor using the different financial approaches.

Figure 9: Carbon Intensity Floor versus Gate Fee Costs



Of the 990 energy generating scenarios, 727 scenarios (73%) result in emissions of 400g CO_2e/kWh or less, and thus meet the current level set for the carbon intensity floor. If the carbon intensity floor level was set at the DECC grid mix in 2011 (469 gCO2e/kWh) then the numbers of scenarios that achieve the target increases to 856, or 86% of the energy generating residual waste scenarios. Correspondingly, if the carbon intensity floor is set at the lower emission level of DECC grid mix in the year 2025 (362gCO_2e/kWh) then the number of technical scenarios achieving the target reduces to 631 (64%).

In terms of whole system municipal costs (net annualised Capex and Opex basis), the majority of scenarios which meet the carbon intensity floor sit between £500m and £650m, with the largest proportion of the scenarios between £550m to £650m. This compares to the current predicted spend of circa £580m per annum on municipal waste management in London[18]. Assessing the NC (no change/do nothing new) scenario using London s 2009/10 municipal waste management methods, the model generates a gross annual Capex and Opex cost estimate of £639m in 2031. The gross figures are presented, as authorities may not see the full benefit of all revenue streams (recyclate sales and energy generation). The model generates a net annual Capex and Opex cost estimate of £614m.

A table summarising the numbers of scenarios achieving the Carbon Intensity Floor is presented below (Table 21).

18 Mayor's Draft Municipal Waste Management Strategy, January 2010.

Table 21: Recycling Options and Performance against the Carbon Intensity Floor

Recycling Scenario	Scenario definition	Number of Scenarios achieving Carbon Intensity Floor	Total number of scenarios modelled	% achieving Carbon Intensity Floor
NC	Do Nothing New (based on London's 2008/09 waste management performance including 25 per cent recycling and composting performance	157	200	79%
lo	25 per cent recycling and composting rate, concentrating on dry recyclables only	162	200	81%
mid -d	Focus on dry recycling without food waste collections achieving 45 per cent recycling rate	139	200	70%
mid -f	Focus on food collection achieving 45 per cent recycling and composting performance through a combination of mixed dry and food collections	133	200	67%
hi	Max GHG abatement achieving 60 per cent recycling and composting rate with particular emphasis on food waste collection	136	200	68%

The "lo" recycling option demonstrates a marginally higher proportion of scenarios achieving the Carbon Intensity Floor, this is associated with the higher CV value from biomass (range of 43-73% for treated (SRF) waste, which compares to 40-70% for treated (SRF) CV from biomass for the "mid-d" recycling option). However, the results do not indicate a significant variation, and as such it can be concluded that the carbon intensity floor is achievable across a range of recycling and composting scenarios (and thus residual waste compositions).

Recycling collection schemes that focus on materials with a high fossil carbon content (e.g. plastics) will result in a waste with a higher CV content from biomass waste which will improve the ability to meet the carbon intensity floor. The focus on materials with a high embodied carbon content (e.g. non ferrous metals) will not necessarily impact on the carbon intensity floor, however it will significantly contribute towards meeting the EPS.

Table 22 details the numbers of scenarios achieving the Carbon Intensity Floor of 400 gCO_2e/kWh or less for each residual treatment technology type.

The proportion of scenarios achieving the Carbon Intensity Floor across different technology types ranges from 0-100%, the energy efficiency of each residual technology type is the key factor determining factor relating to whether an emission level of 400 gCO_2e/kWh is achieved, As an example Incineration with a high performing CHP scheme is the technical option with 100% of scenarios achieving the Carbon intensity Floor. Furthermore, it is apparent that scenarios based on electricity only are more likely to find achieving the carbon intensity floor a challenge. The exception to this statement is where a facility is operating at high energy efficiencies in the order of 30% gross, or where the untreated feedstock is high in biomass (circa 69% CV from biomass)[19]. This means that the RRRF Incinerator could achieve the Carbon Intensity Floor with the correct balance of biomass in the untreated waste due to high energy generating efficiency whereas less efficient facilities are unlikely to do so.

The level and type of pre-treatment is also a factor that impacts on overall carbon intensity.

19 Sensitivity testing of the model was undertaken utilising one of the spare composition slots. The 'No Change' scenario and composition were duplicated, and the residual waste composition was altered (by increasing paper and card, reducing plastics and miscellaneous combustibles) to obtain a CV from biomass of circa 69%. On this basis a scenario with food wastes to aerobic digestion (i.e. no impact on the carbon intensity performance) and untreated waste to Incineration with electricity generation (circa 30% gross) results in a carbon intensity floor performance of 366 gCO_2e/kWh.

Table 22: Residual Treatment Technology Options and Performance against the Carbon Intensity Floor

Technology scenario	Number of scenarios achieving the Carbon Intensity Floor	Total number of scenarios assessed	% achieving Carbon Intensity Floor
MHT 1	94	100	94%
MHT 2*	122	125	98%
MBT aerobic 1	47	100	47%
MBT aerobic 2 (Landfill)	20	25	80%
MBT aerobic 3	53	100	53%
MBT aerobic 4*	92	100	92%
MBT biostab 1	20	25	80%
MBT AD 1 (Landfill)	19	25	76%
MBT AD 2 (SRF)	97	100	97%
Direct to Incineration 1 (electricity only)	4	25	16%
Direct to Incineration 2 (low CHP)	10	25	40%
Direct to Incineration 3 (medium CHP)	22	25	88%
Direct to Incineration 4 (high CHP)	25	25	100%
Direct to Incineration 5 (medium efficiency electricity)	0	25	0%
Direct to Gasification 1	15	25	60%
Direct to Gasification 2	2	25	8%
Direct to Gasification Gas Engine 1	15	25	60%
Direct to Gasification Gas Engine 2	17	25	68%
Direct to True Pyrolysis 1	17	25	68%
Dirty MRF 1	36	50	72%
Total	727	1000	73%

Notes: * These technologies are capable of producing a high biomass SRF.
SRF generated from Pretreatment technologies (MHT, MBT and Dirty MRF) is treated via a number of options - incineration (electricity only), cement kiln, gasification (electricity only) or power station. MHT 1 also includes SRF to gasification (CHP).
Gasification and pyrolysis technologies where MSW is treated directly are assumed to include a degree of on-site pretreatment.

It is not the GLA's intention to seek the lowest carbon intensity performance for energy from waste technologies but to ensure that where energy is generated from waste that the technology achieves as a minimum a carbon intensity performance of 400 g CO_2e/kWh and the waste management scenario, as a whole meets the EPS.

Table 23 details the ten scenarios that achieve 400 gCO_2e/kWh (CIF) or just below and meet the EPS in 2031.

Table 23: Ten Scenarios Closest to the 400gCO2e/kWh Level (all scenarios meet the EPS in 2031)

Option name	Food treatment technology	Fraction of municipal waste recycled (Including residual treatment outputs)	Fraction of municipal waste diverted	Total collection cost (£M)	Total gate fee cost (Inc collection costs) (£M)	Total CAPEX+OPEX (Inc collection costs) (£M)	Net electrical power output (GWh)	Net heat output (GWh)	Net combined energy recovery (GWh)	Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	Achievement of Carbon Floor (Y/N)	EPS (mass) (tCO2e/tonne)	Achievement of the EPS (Y/N)	Total collection cost (£/t)	Total CAPEX+OPEX Disposal Cost (£/t)
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	69%	90%	402	549	568	1,011	0	1,011.41	398.36	Y	-0.27	Y	105.12	43.45
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	69%	90%	402	549	567	1,011	0	1,011.41	398.36	Y	-0.27	Y	105.12	43.30
mid -d recycling, True Pyrolysis 1_total	Dry AD with electricity generation	74%	99%	368	528	497	1,108	0	1,108.02	398.13	Y	-0.32	Y	96.27	33.66
lo recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	70%	91%	418	563	578	855	0	855.09	397.93	Y	-0.38	Y	109.48	41.81
lo recycling, Gasification 1_total	Dry AD with electricity generation	74%	99%	418	586	466	1,193	0	1,193.26	397.43	Y	-0.28	Y	109.48	12.36
hi recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	82%	99%	458	563	578	1,036	0	1,035.57	397.20	Y	-0.38	Y	119.76	31.51
hi recycling, MBT AD 1 (Landfill), SRF to incineration_generic	Dry AD with electricity generation	79%	95%	458	588	597	899	0	899.22	397.09	Y	-0.33	Y	119.76	36.40
mid -d recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	74%	99%	368	528	525	913	320	1,232.49	395.96	Y	-0.31	Y	96.27	41.18
mid -d recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	74%	99%	368	528	525	913	320	1,232.49	395.96	Y	-0.31	Y	96.27	41.10
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	75%	98%	402	514	548	1,136	0	1,136.09	395.52	Y	-0.34	Y	105.12	38.21

The scenarios with the lowest carbon intensity performance levels (i.e. closest to 0gCO_2e/kWh) are those scenarios which do not generate electricity or heat from residual waste (e.g. MBT aerobic with SRF to landfill, MBT biostabilisation) with food waste treated via anaerobic digestion. In these scenarios the direct emissions from AD are relatively small in comparisons to the energy output figures and thus a low carbon intensity performance figure (circa 20 - 50 gCO_2e/kWh) is achieved. However, the scenarios can be comparatively more costly, as a significant quantity of SRF or biostabilised material is disposed in landfill with increasing landfill tax rates applied.

A number of key conclusions relating to the Carbon Intensity performance of scenarios are summarised below:

- The carbon intensity floor for electricity generation can be achieved via the full range of recycling options. Recycling options that concentrate on high embedded carbon materials such as metals, plastics and textiles can be beneficial due to the higher organic component left in the residual waste stream and thus higher calorific value from biomass;
- The efficiency of energy recovery is a key factor with respect to whether the carbon intensity floor level of 400 gCO_2e/kWh will be achieved. In general scenarios generating electricity from residual waste will achieve the carbon intensity floor if the waste exhibits high biomass content and/or a high energy efficiency facility is utilised;
- The treatment of food waste through Anaerobic Digestion (with energy recovery, biogas injection to grid, or biogas converted to a transport fuel) results in a low carbon intensity performance due to the 100 per cent biogenic nature of the feedstock. Thus, the treatment of food waste via AD as opposed to IVC can assist in reducing the overall carbon intensity performance of the waste management solution;
- As a zero carbon impact technology AD offers the opportunity to compensate for high carbon intensity residual treatment options such that the aggregated carbon intensity performance of a scenario is able to achieve the Carbon Intensity Floor.

In summary, based on the modelling undertaken and the scenarios assessed, the Carbon Intensity Floor level set as 400 gCO_2e/kWh results in a position where a significant number of recycling and residual waste management scenarios are capable of achieving the level or exceeding the requirement.

3.5.2 Performance against the EPS

The EPS is a measure of the carbon footprint of waste management measured as tonnes carbon dioxide equivalent per tonne MSW managed (tCO_2e/ tMSW). Meeting the carbon intensity floor for energy generated from waste forms an important part in meeting the EPS.

Performance of the modelled scenarios compared to the EPS (for different years) is depicted in Figure 10, 11 and 12; each scenario is shown as a single point characterised by carbon emissions and cost. Scenarios that fall below the red line meet the EPS; conversely those above the red line fail to meet the EPS.

A total of 1,000 scenarios are presented on the scatter charts in Figure 10, 11, 12 which present whole system municipal costs (using differing methodologies) and CO_2e performance against the Emissions Performance Standard.

Figure 10: EPS versus Gross Capex/Opex Costs

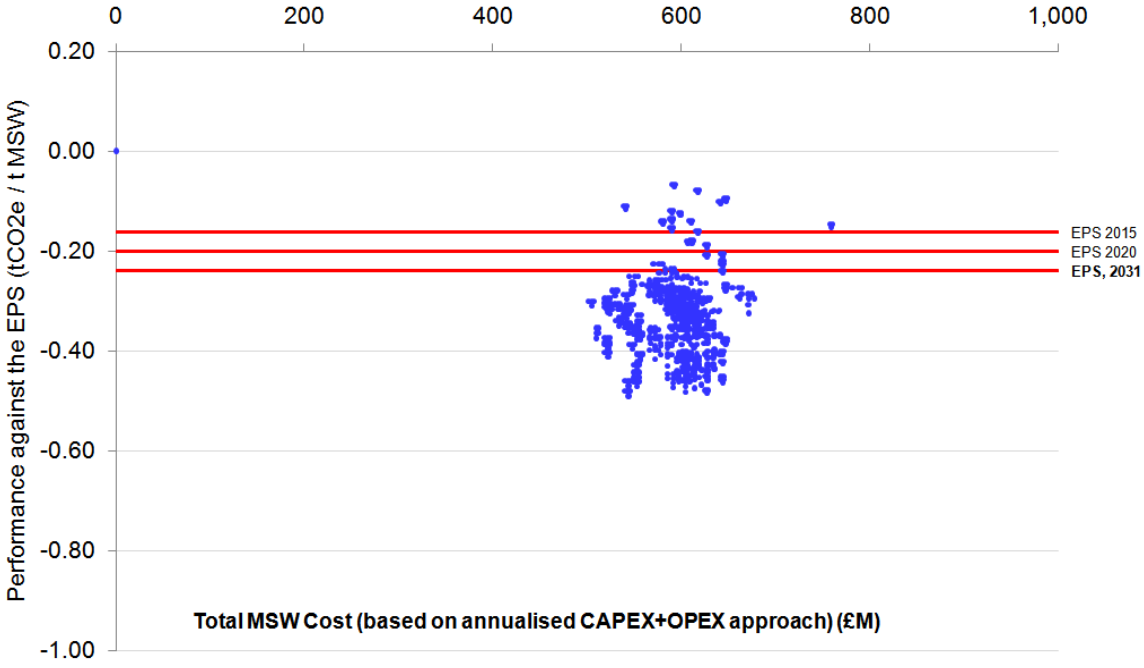


Figure 11: EPS versus Net Capex/Opex Costs

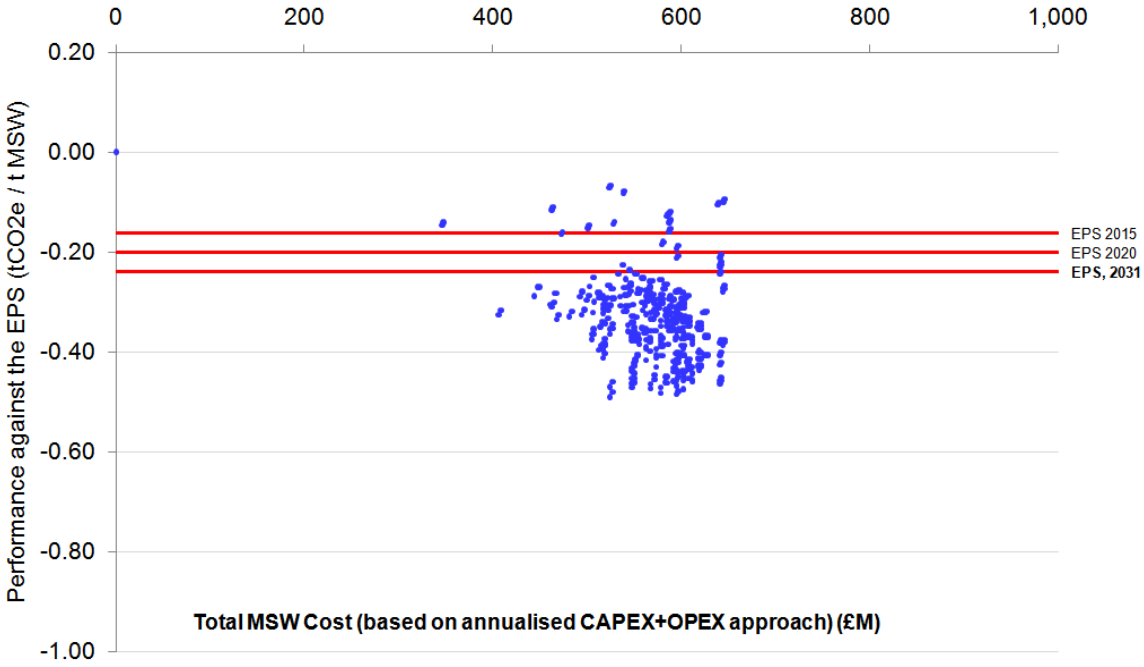
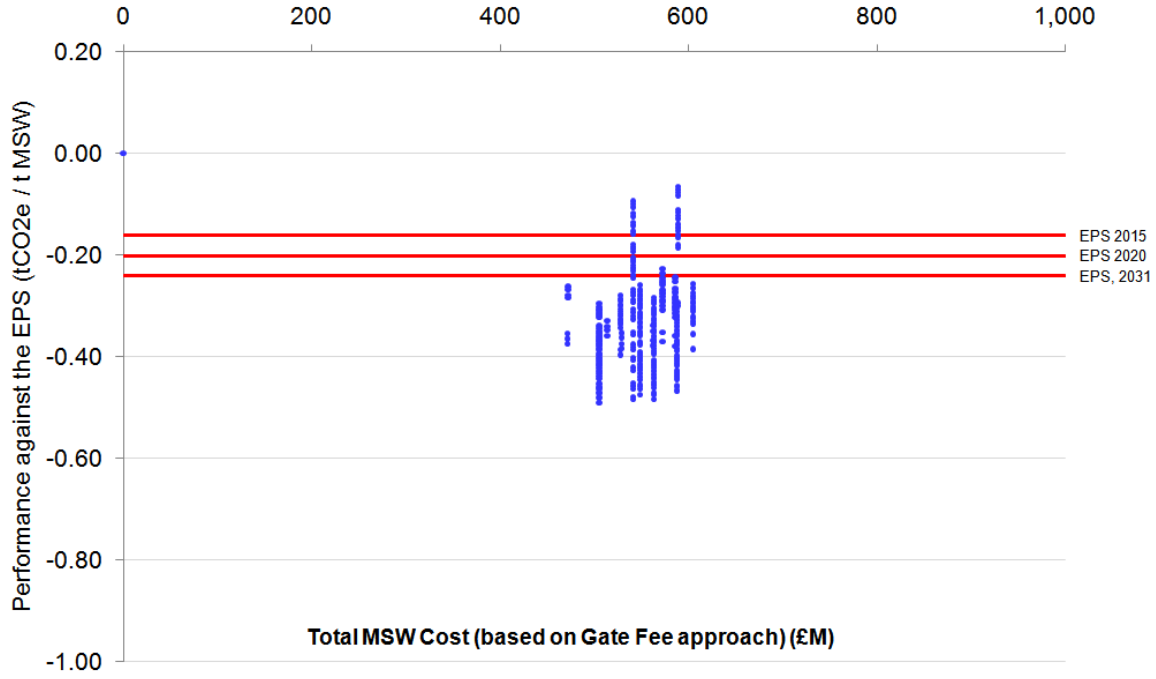


Figure 12: EPS versus Gate Fee Costs



In terms of whole system municipal costs (net annualised Capex and Opex basis), the majority of scenarios meeting the EPS sit between £500m and £650m, with the largest proportion of the scenarios between £550m to £650m.

The modelling demonstrates that the more expensive scenarios incorporate pre-treatment technologies; primarily MBT aerobic with SRF to landfill, MBT aerobic producing a high biomass SRF, and MHT processes. The primary reasons for higher cost are multiple gates fees associated with double handling of the waste and higher proportions of waste consigned to landfill.

In total, 883 of the 1,000 scenarios modelled meet the EPS levels set up until the year 2031 (currently set at -0.24 tCO_2e/tMSW). The numbers of scenarios achieving the EPS in each target year is presented in Table 24; demonstrating that the reduction in EPS level between target years results in a reduction of scenarios able to meet the EPS level.

Table 24: Scenarios Achieving EPS in Key Target Years

	2015	2020	2031
Scenarios achieving EPS	965	916	883
% of scenarios achieving EPS	97%	92%	88%

A breakdown of performance by recycling option is presented in Table 25. The scenarios modelled indicate that a no change position will result in a decreasing number of scenarios capable of meeting the EPS as the targets become more stringent. In comparison, the scenarios with increasing recycling performance are resulting in high proportions of scenarios meeting the EPS in 2031. Therefore as long as the recycling rate improves from the No Change position the type of recycling scenario appears to have little influence on meeting the EPS in 2031.

Table 25: Scenarios and EPS Performance by Recycling Option

	Scenarios achieving EPS in:			Total number of scenarios modelled	% of scenarios achieving the 2031 EPS
	2015	2020	2031		
NC	165	116	91	200	46%
lo	200	200	200	200	100%
mid -d	200	200	200	200	100%
mid -f	200	200	192	200	96%
hi	200	200	200	200	100%
Total	965	916	883	1,000	88%

The number of scenarios achieving the EPS in 2031 by each technology type is presented in Table 26.

Table 26: Scenarios by Technology Type Achieving the EPS in 2031

Technology type	Number of scenarios achieving the EPS	Total number of scenarios assessed	% achieving EPS
MHT 1	90	100	90%
MHT 2*	116	125	93%
MBT aerobic 1	90	100	90%
MBT aerobic 2 (Landfill)	20	25	80%
MBT aerobic 3	90	100	90%
MBT aerobic 4*	100	100	100%
MBT biostab 1	20	25	80%
MBT AD 1 (Landfill)	20	25	80%
MBT AD 2 (SRF)	90	100	90%
Direct to Incineration 1 (electricity only)	20	25	80%
Direct to Incineration 2 (low CHP)	20	25	80%
Direct to Incineration 3 (medium CHP)	20	25	80%
Direct to Incineration 4 (high CHP)	25	25	100%
Direct to Incineration 5 (medium efficiency electricity)	16	25	64%
Direct to Gasification 1	20	25	80%
Direct to Gasification 2	16	25	64%
Direct to Gasification Gas Engine 1	20	25	80%
Direct to Gasification Gas Engine 2	20	25	80%
Direct to True Pyrolysis 1	20	25	80%
Dirty MRF 1	50	50	100%
Total	**883**	**1,000**	**88%**

Notes: * These technologies are capable of producing a high biomass SRF.
SRF generated from Pretreatment technologies (MHT, MBT and Dirty MRF) is treated via a number of options - incineration (electricity only), cement kiln, gasification (electricity only) or power station. MHT 1 also includes SRF to gasification (CHP).
Gasification and pyrolysis technologies where MSW is treated directly are assumed to include a degree of on-site pretreatment.

Table 27 presents the ten lowest performing scenarios that meet the EPS, whilst Table 28 the ten scenarios closest to the EPS target in 2031 (-0.24 tCO_2e/t); All scenarios presented in Table 27 and Table 28 perform below the carbon intensity floor in addition to meeting the EPS.

Table 27: Scenarios demonstrating the Lowest EPS performance (scenarios below meet the carbon intensity floor)

Option name	Food treatment technology	Fraction of municipal waste recycled (including residual treatment outputs)	Fraction of municipal waste diverted	Total collection cost (£M)	Total gate fee cost (Inc collection costs) (£M)	Total CAPEX+OPEX (Inc collection costs) (£M)	Net electrical power output (GWh)	Net heat output (GWh)	Net combined energy recovery (GWh)	Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	Achievement of Carbon Floor (Y/N)	EPS (mass) (tCO2e/tonne)	Achievement of the EPS (Y/N)	Total collection cost (£/t)	Total CAPEX+OPEX Disposal Cost (£/t)
mid -d recycling, MBT AD (SRF), SRF to cement_kiln	Wet AD with electricity generation	67%	95%	368	505	524	193	2,317	2,509.46	100.44	Y	-0.49	Y	96.27	40.94
NC recycling, MBT AD (SRF), SRF to cement_kiln	Wet AD with electricity generation	32%	87%	317	541	595	270	5,254	5,524.28	94.15	Y	-0.48	Y	83.05	72.72
lo recycling, MBT AD (SRF), SRF to cement_kiln	Wet AD with electricity generation	68%	95%	418	563	579	300	2,634	2,934.82	106.84	Y	-0.48	Y	109.48	41.93
mid -d recycling, MBT AD (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	67%	95%	368	505	527	323	2,317	2,640.20	95.46	Y	-0.48	Y	96.27	41.71
mid -d recycling, MBT AD (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	67%	95%	368	505	527	323	2,317	2,640.20	95.46	Y	-0.48	Y	96.27	41.62
mid -d recycling, MBT AD (SRF), SRF to cement_kiln	Dry AD with electricity generation	67%	95%	368	505	526	193	2,317	2,509.46	102.52	Y	-0.48	Y	96.27	41.49
mid -d recycling, MBT AD (SRF), SRF to cement_kiln	Aerobic Digestion	67%	95%	368	505	526	105	2,317	2,422.31	103.44	Y	-0.48	Y	96.27	41.49
NC recycling, MBT AD (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	32%	87%	317	541	597	339	5,254	5,592.77	93.00	Y	-0.48	Y	83.05	73.12
NC recycling, MBT AD (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	32%	87%	317	541	597	339	5,254	5,592.77	93.00	Y	-0.48	Y	83.05	73.07
NC recycling, MBT AD (SRF), SRF to cement_kiln	Dry AD with electricity generation	32%	87%	317	541	596	270	5,254	5,524.28	94.65	Y	-0.48	Y	83.05	73.00

Table 28: Scenarios closest to the EPS target in 2031 (scenarios below meet the carbon intensity floor)

Option name	Food treatment technology	Fraction of municipal waste recycled (including residual treatment outputs)	Fraction of municipal waste diverted	Total collection cost (£M)	Total gate fee cost (inc collection costs) (£M)	Total CAPEX+OPEX (inc collection costs) (£M)	Net electrical power output (GWh)	Net heat output (GWh)	Net combined energy recovery (GWh)	Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	Achievement of Carbon Floor (Y/N)	EPS (mass) (tCO2e/tonne)	Achievement of the EPS (Y/N)	Total collection cost (£/t)	Total CAPEX+OPEX Disposal Cost (£/t)
NC recycling, Dirty MRF 1, SRF to incineration_generic	Aerobic Digestion	50%	97%	317	472	546	1,833	0	1,832.92	372.55	Y	-0.26	Y	83.05	59.82
mid -f recycling, Incineration 2 (low CHP)	Wet AD with biogas to transport fuel	73%	99%	402	573	570	1,211	375	1,586.47	395.17	Y	-0.26	Y	105.12	43.94
mid -f recycling, Incineration 2 (low CHP)	Wet AD with biogas to grid injection	73%	99%	402	573	569	1,211	375	1,586.47	395.17	Y	-0.26	Y	105.12	43.78
lo recycling, Gasification 2	Wet AD with biogas to transport fuel	74%	99%	418	586	560	1,176	0	1,176.15	393.60	Y	-0.25	Y	109.48	37.13
lo recycling, Gasification 2	Wet AD with biogas to grid injection	74%	99%	418	586	560	1,176	0	1,176.15	393.60	Y	-0.25	Y	109.48	36.95
NC recycling, MHT 2, SRF to ATT_generic	Wet AD with electricity generation	52%	91%	317	541	641	1,382	0	1,381.97	269.14	Y	-0.24	Y	83.05	84.71
NC recycling, MHT 2, SRF to ATT_generic	Wet AD with biogas to transport fuel	52%	91%	317	541	643	1,450	0	1,450.45	256.43	Y	-0.24	N	83.05	85.11
NC recycling, MHT 2, SRF to ATT_generic	Wet AD with biogas to grid injection	52%	91%	317	541	642	1,450	0	1,450.45	256.43	Y	-0.24	N	83.05	85.07
NC recycling, MHT 2, SRF to ATT_generic	Dry AD with electricity generation	52%	91%	317	541	642	1,382	0	1,381.97	271.12	Y	-0.24	N	83.05	85.00
NC recycling, MHT 2, SRF to ATT_generic	Aerobic Digestion	52%	91%	317	541	642	1,336	0	1,336.31	277.76	Y	-0.24	N	83.05	85.00

It should be noted that the calculations used for determining performance against the EPS within the current model include waste transport costs but do not account for emissions associated with the transportation of waste. In SLR's previous experience, the CO_2e impacts of transportation (when assessing a full MSW solution) are relatively minor in comparison to the impacts associated with the recycling and residual treatment processes. It is important to note however that the financial estimates do account for transport costs. The latest EPS report by Eunomia concludes that the total emissions associated with meeting the EPS for London in 2031 is -1,029.8 $ktCO_2e$, transportation contributes 43.9 $ktCO_2e$ to the total figure, thus demonstrating a small overall impact relative to the emissions associated with reprocessing and treatment of materials.

A number of key conclusions relating to the EPS are summarised below:

- The modelling undertaken indicates that the EPS can be achieved by a range of recycling options and technical scenarios. In total, 88% of the scenarios assessed are shown to meet the EPS in 2031;
- The majority of scenarios which do not meet the EPS in 2031 are based on No Change recycling performance;
- The scenarios with higher recycling performance (in particular recyclables with high embodied carbon content) perform well against the EPS;
- The lowest collection cost per tonne scenarios are those No Change scenarios, as the cost of collecting dry recyclables and organics is greater than for residual materials. With respect to disposal costs, the scenarios offering the lowest cost per tonne (and achieving the carbon intensity floor and EPS) are gasification and Incineration technologies without pretreatment;
- Technology scenarios with high electrical energy efficiency or operating in CHP mode also perform well against the EPS.
- Scenarios that include SRF to cement kilns perform well because 100% of the SRF energy is displacing the conventional fuel (primarily coal);
- The EPS is flexible, in that it can be achieved through a combination of recycling, food waste, pre-treatment and residual waste management approaches; achieving high performance is dependent on achieving an optimum balance of all of these elements;
- The current predicted spend on municipal waste management in London is circa £580m per annum[20]. Assessing the NC (no change/do nothing new) scenario using London s 2009/10 municipal waste management methods, the model generates a gross annual Capex and Opex cost estimate of £639m in 2031. The gross figures are presented, as authorities may not see the full benefit of all revenue streams (recyclate sales and energy generation). The model generates a net annual Capex and Opex cost estimate of £614m.

In summary, the modelling undertaken indicates that the EPS target in 2031 of -0.24 tCO_2e/t waste can be met or exceeded through a range of waste management scenarios providing Authorities with the flexibility to adopt waste management approaches that suit their own particular circumstances.

3.5.3 Further details of Scenarios assessed and performance against the Carbon Intensity Floor and EPS levels

In total, 600 of the 975 scenarios assessed in the model achieve the EPS in 2031 (-0.24 tCO_2e/t or below) and perform at or below the Carbon intensity Floor Level (400

20 Mayor's Draft Municipal Waste Management Strategy, January 2010.

gCO_2e/kWh). The highest performing treatment technologies by recycling options and technology type are displayed in Table 29.

In terms of whole system municipal costs (net annualised Capex and Opex basis), the majority of scenarios meeting the carbon intensity floor and EPS sit between £405m and £645m**,** with the largest proportion of the scenarios between £550m to £625m. This compares to the current predicted spend of circa £580m per annum on municipal waste management in London[21].

21 Mayor's Draft Municipal Waste Management Strategy, January 2010.

Table 29: Numbers of Scenarios Achieving the Carbon Intensity Floor and EPS (2031) Requirements

Recycling scenarios > Technology scenarios↓	NC 25%	Lo 25%	mid –d 45%	mid –f 45%	Hi 60%	Total	% of total scenarios modelled	Collection cost per tonne range (£/t)	Disposal cost per tonne range (net£/t)
Direct to Incineration 4 (high CHP)	5	5	5	5	5	25	100%	83-120	33-65
MBT aerobic 4*	20	19	18	18	17	92	92%	83-120	42-86
MHT 2*	16	25	25	24	23	113	90%	83-120	40-85
MBT AD 2 (SRF)	10	20	20	19	18	87	87%	83-120	36-73
MHT 1	10	19	20	18	17	84	84%	83-120	40-85
Dirty MRF 1	10	9	6	6	5	36	72%	83-120	32-60
Direct to Incineration 3 (medium CHP)	0	5	5	4	3	17	68%	83-120	35-43
MBT biostab 1	0	4	4	4	4	16	64%	83-120	42-51
MBT aerobic 2 (Landfill)	0	4	4	4	4	16	64%	83-120	42-51
MBT AD 1 (Landfill)	0	4	4	2	4	14	56%	83-120	35-43
MBT aerobic 3	10	13	7	10	13	53	53%	83-120	36-71
Direct to Gasification Gas Engine 2	0	4	4	2	2	12	48%	83-120	26-29
Direct to True Pyrolysis 1	0	4	4	2	2	12	48%	83-120	32-36
MBT aerobic 1	7	13	7	9	11	47	47%	83-120	36-71
Direct to Gasification 1	0	4	2	2	2	10	40%	83-120	11-15
Direct to Gasification Gas Engine 1	0	4	2	2	2	10	40%	83-120	30-33
Direct to Incineration 2 (low CHP)	0	2	2	2	2	8	32%	83-120	38-44
Direct to Incineration 1 (electricity only)	0	2	0	0	2	4	16%	83-120	26-28
Direct to Gasification 2	0	2	0	0	0	2	8%	83-120	37
Direct to Incineration 5 (medium efficiency electricity)	0	0	0	0	0	0	0%	83-120	-

Notes: * These technologies are capable of producing a high biomass SRF.
SRF generated from Pretreatment technologies (MHT, MBT and Dirty MRF) is treated via a number of options - incineration (electricity only), cement kiln, gasification (electricity only) or power station. MHT 1 also includes SRF to gasification (CHP).
Gasification and pyrolysis technologies where MSW is treated directly are assumed to include a degree of on-site pretreatment.

Output tables presenting the scenarios assessed, the generation efficiencies and calorific value derived from biomass are presented in Appendices C, D and E. Appendix C presents all the scenarios sorted by scenario name. Appendix D ranks the scenarios on their performance against the carbon intensity floor; the scenario with the lowest gCO2e/kWh is presented first. Appendix E presents the scenarios that achieve the EPS in 2031 and carbon intensity floor, again ranked on their performance against the carbon intensity floor.

The tables in Appendices C-E include the EPS value, the best EPS year achieved by the scenario and cost data for each scenario (total £m, £/t collection and £/t disposal based on the net annualised Capex and Opex approach).

3.5.4 Performance of Energy from Waste Options

The model includes a number of different options for energy generation including incineration with and without CHP, cement kilns, co-firing in coal fired power stations and advanced thermal treatment plants with and without CHP.

Consideration has been given to how these technologies perform as illustrated in Table 30. The figures presented are for a scenario where food waste is treated through Aerobic Digestion, and thus the carbon intensity floor performance is associated with the residual treatment only; the mid-f recycling scenario is used as an example.

Table 30: Performance Comparison of different Energy from Waste Options (untreated waste to Energy from Waste, or pre-treatment technologies with High Biomass SRF to Energy from Waste)

AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs
				Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection
Aerobic Digestion	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	471.66	-0.31	2031	595.5
Aerobic Digestion	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	126.95	-0.42	2031	595.5
Aerobic Digestion	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	428.83	-0.32	2031	595.5
Aerobic Digestion	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	351.04	-0.41	2031	595.5
Aerobic Digestion	mid -f	MBT aerobic 1	incineration_generic	30%	0%	-	38%	714.82	-0.26	2031	566.2
Aerobic Digestion	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	192.23	-0.36	2031	566.2
Aerobic Digestion	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	649.37	-0.27	2031	566.2
Aerobic Digestion	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	531.55	-0.37	2031	566.2
Aerobic Digestion	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	0.00	-0.28	2031	596.8
Aerobic Digestion	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	0.00	-0.28	2031	594.2
Aerobic Digestion	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	480.19	-0.30	2031	562.8
Aerobic Digestion	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	415.95	-0.30	2031	571.0
Aerobic Digestion	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	123.01	-0.46	2031	571.0
Aerobic Digestion	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	377.32	-0.32	2031	571.0
Aerobic Digestion	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	316.21	-0.45	2031	571.0
Aerobic Digestion	mid -f	Incineration 1 (electricity only)_total	#N/A	30%	0%	52%		555.21	-0.25	2031	506.4
Aerobic Digestion	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		523.96	-0.26	2031	568.1
Aerobic Digestion	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		418.53	-0.29	2031	565.4
Aerobic Digestion	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		298.42	-0.35	2031	557.9
Aerobic Digestion	mid -f	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	52%		700.42	-0.23	2020	537.2
Aerobic Digestion	mid -f	Gasification 1_total	#N/A	30%	0%	52%		504.17	-0.27	2031	447.8
Aerobic Digestion	mid -f	Gasification 2_total	#N/A	21%	0%	52%		718.60	-0.24	2020	544.6
Aerobic Digestion	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		489.49	-0.27	2031	525.7
Aerobic Digestion	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		461.54	-0.28	2031	511.5
Aerobic Digestion	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		465.12	-0.27	2031	539.2
Aerobic Digestion	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	492.11	-0.33	2031	547.7
Aerobic Digestion	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	446.99	-0.34	2031	547.7
Aerobic Digestion	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	186.04	-0.40	2031	595.5

Although Table 30 is not a comprehensive list of energy generation options it does illustrate the benefit of cement kilns against the carbon floor and the EPS; it also shows the benefit of CHP enabled gasification as compared to electricity only incineration and electricity only gasification (ATT_generic).

Performance of Pre-treatment Technologies

Pre-treatment technologies offer the opportunity to recover additional recyclables and to condition the residual waste prior to energy generation. The choice of pre-treatment technology, therefore, has a direct impact on performance against the carbon intensity floor and EPS. The model includes a number of pre-treatment technologies as follows[22]:

- MHT – Mechanical Heat Treatment / Autoclaving
- MBT aerobic – Mechanical Biological Treatment with biodrying
- MBT AD - Mechanical Biological Treatment utilising anaerobic digestion
- Dirty MRF – Material Recycling Facility

Performance of the pre-treatment technologies is illustrated in Table 31.

Table 31: Number of Pre-treatment Technologies Meeting the Carbon Intensity Floor and EPS (2031)

	Secondary Treatment							
Primary Technology	Gasification (electricity only)	Cement Kiln	Gasification CHP	Incineration (electricity only)	Power Station	Landfill	Total	% of total scenarios
MHT 1	18	25	0	17	24	0	84	84%
MHT 2	20	25	25	18	25	0	113	90%
MBT aerobic 1	6	25	0	4	12	0	47	47%
MBT aerobic 2 (Landfill)	0	0	0	0	0	16	16	64%
MBT aerobic 3	6	25	0	4	18	0	53	53%
MBT aerobic 4	22	25	0	21	24	0	92	92%
MBT biostab 1	0	0	0	0	0	16	16	64%
MBT AD 1 (Landfill)	0	0	0	14	0	0	14	56%
MBT AD 2 (SRF)	19	25	0	18	25	0	87	87%
Dirty MRF 1	21	0	0	15	0	0	36	72%
Total	**112**	**150**	**25**	**111**	**128**	**32**	**558**	**74%**

The majority of pre-treatment technologies are shown to deliver a high level of compliance against the carbon intensity floor and EPS; however certain technologies, for example forms of mechanical heat treatment or MBT with high levels of recovery, deliver very high compliance against the carbon intensity floor and EPS with over 90% of scenarios meeting or exceeding the minimum targets.

22 The list of primary technologies includes MBT biostabilisation – Mechanical Biological Treatment with full biostabilisation which is not a pre-treatment technology as the outputs are consigned to landfill

4 TECHNICAL FEASIBILITY

The analysis undertaken by SLR and others indicates that CHP operation represents an important factor in determining performance against the carbon intensity floor and EPS. Whilst the analysis indicates a benefit attributable to CHP it is important to understand the various factors that can affect whether CHP systems are commercially viable.

Equally, it is important to understand the commercial and technical implications that may affect production and subsequent utilisation of high biomass fuels derived from municipal waste.

This section seeks to identify and subsequently analyse the commercial and logistical implications associated with generation and utilisation of high biomass fuels and the commercial realisation of CHP enabled schemes. In particular this section considers the following issues:

- The operational implications for pre-treatment technologies producing high-biomass waste fuels;
- Operational implications of facilities accepting high biomass fuels;
- The market appetite for energy generation using high-biomass waste feedstocks;
- Commercial opportunities for thermal facilities operating in CHP mode; and,
- Opportunities for retrofitting existing facilities

In each case the analysis identifies the key determining factors that influence performance and probability of success.

The overall conclusion is one of optimism; there are no aspects that prove insurmountable in developing future CHP infrastructure and creation of high biomass fuels, rather there are technical issues that need to be taken into consideration to facilitate success.

4.1 Operational implications for pre-treatment technologies producing high-biomass waste fuel for energy generation from municipal waste

4.1.1 Process Conditions to achieve high biomass fuels

A wet separation stage is usually considered essential, if fuel with a very low inert material content is required. Wet processing also helps to reduce concentrations of other potential fuel contaminants such as heavy metals etc.

Maintaining a consistent quality output, in spite of feedstock variability, is a major consideration. The quantity of high biomass SRF able to be produced is determined by the properties of the input feed / waste. The consistency (or lack of) of a feedstock will impact on the consistency of both the fuel quality and quantity produced.

Front-end mixing processes can aid feedstock consistency but only in the very short term i.e. on an hourly/daily basis. However, longer term consistency on a weekly/monthly/seasonal basis is unlikely to be achieved. Consistency on a weekly basis may be feasible by providing a feed bunker with five days storage capacity, as would normally be the case for a conventional Incineration facility. Variation in quality/quantity of the final process output(s) will therefore need to be accepted as being the likely norm.

In almost all cases where a high biomass fuel is created the non-recyclable fossil carbon components are discarded as a process reject or converted into a low biomass SRF. Waste stream components that are likely to be dealt with in this manner include plastic films, man-made textiles and various types of rubber.

In summary the production of high biomass fuels is entirely possible providing that suitable processing equipment is included within the separation train.

4.1.2 Performance of Pre-treatment Technologies

A number of pre-treatment technologies are capable of producing high fibre biomass fuels as indicated below. Providing that the right technology is chosen there is no reason to assume that these fuels cannot be produced commercially although the biomass content will vary considerably between different technologies.

4.1.3 Performance of Pre-treatment Technologies

Autoclaving

Autoclaves can produce fibre with a high biomass content (80 – 90%) although the technologies are unlikely to achieve true 'biomass' status as defined in the Renewable Obligation Order[23].

Orchid

The Orchid process is capable of producing a high biomass fuel with the following characteristics.

Table 32: Characteristics of High Biomass Fuel from the Orchid process

Fuel characteristic	Unit	Trend Values		
		Typical Value	Lower Quartile	Upper Quartile
Ash Content	%	14.5	10.5	17
Moisture Content *	%	19	17	22
Gross Calorific Value	MJ/kg ar	14	13	16
Net Calorific Value	MJ/kg ar	12.5	11	13.5
Biomass Content by CV	%	80	75	85

Production of the high biomass system is achieved by use of Orchid's patented biomass separator, an air-based separation system. Where the biomass content of the input fuel is low the high biomass fuel characteristics are achieved by blending with biomass fuels such as waste wood.

23 "biomass" means fuel used in a generating station where at least 90 per cent of its energy content is derived from relevant material (that is to say,material which is, or is derived directly or indirectly from, plant matter, animal matter, fungi or algae

ART

The ART process is capable of generating a high biomass fuel with net CV in the range 11-14MJ/kg and biomass content in excess of 90% by calorific value.

MBT Solutions

MBT technologies based on bio-drying or bio-stabilisation technologies are not generally capable of achieving biomass contents above 50-60% without substantial implications on the reject rates of the plant.

Most MBT solutions seek to remove a significant proportion of the dense plastic fraction (where suitable markets are available); however film plastics are more difficult to remove and these tend to remain in the SRF contributing to the non-biogenic energy content.

Effectively, it is possible to achieve a high biomass fuel by additional processing; however this generally occurs at the expense of higher reject rates to landfill or creation of a secondary SRF stream with low biomass content. Additional processing attracts higher operating costs which, typically, are not reflected in greater financial value for the fuel.

Other Plants

The revised front-end stage for the DiCom process technology developed by AnaeCo in Australia, is reported to be able to produce a +85-90% biomass SRF and in combination with a washing stage, to remove inert materials followed by bio-drying/composting to dry the product, a RDF/SRF biomass content of +95%.

The Donarbon MBT/IVC plant in Cambridgeshire is understood to produce a +90% bio-fuel utilising densimetric tables to separate out organic and inert materials. If the biomass content or CV needs adjustment, waste wood is added.

4.2 Operational implications for energy generation technologies accepting high-biomass feedstocks

The operational implications of combusting high biomass feedstocks are very much dependent on the form of energy generation technology. The implications for individual technologies are considered in turn below.

Incineration

For existing incineration technologies the main issue is likely to be the higher calorific value compared to raw MSW and the implications that this will have on waste throughput and hence gate fee. These issues are discussed in more detail in section 4.3. In new plant the acceptance of high biomass feedstocks can be compensated for at design stage and therefore there are no significant operation implications of accepting high biomass feedstocks.

Gasification and Pyrolysis

Treatment of biomass feedstocks through gasification and pyrolysis is more technically proven than for MSW. . For these technologies the biomass content of the input fuel has minimal operational implications; it is the form of the fuel and the degree of homogeneity that affects the performance of the plant. Feedstock composition directly affects the quality, composition and variability of syn-gas quality as well as the level of contaminants, which in

turn dictates gas cleanup requirements. Consequently, the homogeneous nature of high biomass feedstocks results in significantly less operational implications than for mixed MSW.

Power Stations

Large coal fired power stations, for example DRAX and Tilbury, are progressing with plans to introduce co firing of virgin biomass with coal. For power stations the implications of accepting high biomass feedstocks derived from MSW are twofold; the waste status of the feedstock and the levels of chemical comtaminants.

In theory co-firing of high biomass SRF in coal fired boilers may be practical across a wide range of input quantities. Most co-firing systems will look to achieve no greater than 40% of input calorific value from SRF, due to limitations in the flue gas handling system.

However, co-firing of high biomass SRF would require plant exhaust gas treatment to be compliant with WID emissions and this may be a barrier to utilisation in certain cases for existing facilities.

A key issue with any SRF material which may limit its use in coal fired power stations is the potential contaminant and ash levels.. Typically, concerns relate to the potential for high concentrations of contamination from chlorine (present both from foodstuffs as salt [NaCl][24] or from PVC film materials), high ash content, and the presence of heavy metals. These contamination issues, or potential for contamination, are often cited as reasons for utilising SRF only in plant specifically designed and built to accommodate such contamination through the use of higher grade materials in construction of key elements of the plant i.e. possibly corrosion issues etc..

Table 33 indicates typical chemical compositions for a high biomass SRF (fibre fuel), combusted at the Slough Heat and Power Plant and SRF which was used in testing in 2007. Details of the testing and the outcomes are given in Figure 13.

Table 33: Typical Chemical Compositions of Fibre Fuel and SRF

Average Values	Fibre Fuel	Test SRF
GCV (MJ/kg)	15.2	18.9
Total Moisture AR (%)	11.8	13
Ash Content AR (%)	15.8	13
Total Sulphur AR (%)	0.14	0.17
Total Chlorine AR (%)	0.11	0.35
Total Nitrogen AR (%)	0.33	1.84
Sulphur to Chlorine ratio	1.3	0.49

[25]

For co-firing SRF in coal fired power plants, critical parameters requiring control for high quality SRF are particle size, halogen concentration, and concentration of abrasive inert materials.

24 Chlorine content is also a major consideration for other SRF consumers. For example cement kilns, the main consumer of SRF in Europe, accept (baled) SRF with a maximum chlorine content <1%.
25 www.resourcesnotwaste.org/upload/.../3.2.John%20Watson.pdf

Figure 13: Slough Heat and Power SRF Testing

July – August 2007 – Test Burn

A test burn of SRF was completed at the Slough Heat and Power Energy station using SRF from an MBT plant. In total 3,500 tonnes of SRF were processed during the trial. On this basis the trial and outcomes can be considered to be representative of a fully operating commercial plant.

Issues identified during the trials include:

- Fuel proved not to flow readily through the screw feeders to the bunker causing cohesive arching and erratic boiler operation. This issue was resolved through modifications to the feeder screws.
- The lower bulk density of the SRF caused high volumes of fuel to be drawn up into the air stream to the superheaters. As a result higher fuel volumes than desired were burned in suspension, resulting in a low level fuel bed on the boiler grate.
- Boiler performance was often erratic with both CO2 & HCI spiking.
- Increased fly ash production and lime consumption.
- Gaseous chlorine attack on tubing leading to cracking, flaking and eventual failure.

Following the trials the superheaters were deemed beyond normal cleaning and economical repair, requiring replacement. A third party review of the trials by Fichtner came up with the following conclusions:

- Increased corrosion rates.
- SRF blending should be kept to a maximum of 10% if used at all.
- Flue gas entry temperatures to the superheaters should be lowered and maintained at 650C.
- Increased cleaning, both on and off line will be required, impacting on boiler availability.
- Increased fly ash production and lime consumption will lead to increased operating, transport and disposal costs.

As a result of the trials the following plans were adopted:

- “Ready to Use” (RTU) fuels would be targeted and sourced from sectors that are able to source segregate and produce fuels with lower chlorine levels.

- Fibre Fuel production will continue in the short term, but will be phased out as RTU fuels become more readily available.

- Further investment in the Fibre Fuel front end process will be made to improve segregation and reduce contamination levels.

- SSE is proposing a further 25MWe extension to the Slough site, which is anticipated to be on line by 2012. The new plant will be more tolerant of chlorine rich fuels and far more “fuel flexible” than Boiler 17. The plant will have a requirement for approximately 120k tonnes per annum of waste derived fuels, with SRF featuring strongly in the mix. Once on line the combined annual requirement for waste derived fuels for these two boilers will be approximately 250k tonnes.

4.3 Market Appetite for Energy Generation using High-Biomass Waste Feedstock

The market appetite for high biomass feedstocks is presently far from clear. Individual waste to biomass producers claim to have a good customer base and there is certainly interest from the cement industry in SRF, although not specifically for high biomass feedstocks. Furthermore, the market for SRF in the cement industry is subject to high levels of uncertainty due to a decline in the construction industry and subject to other higher CV fuels such as tires and liquid fuels.

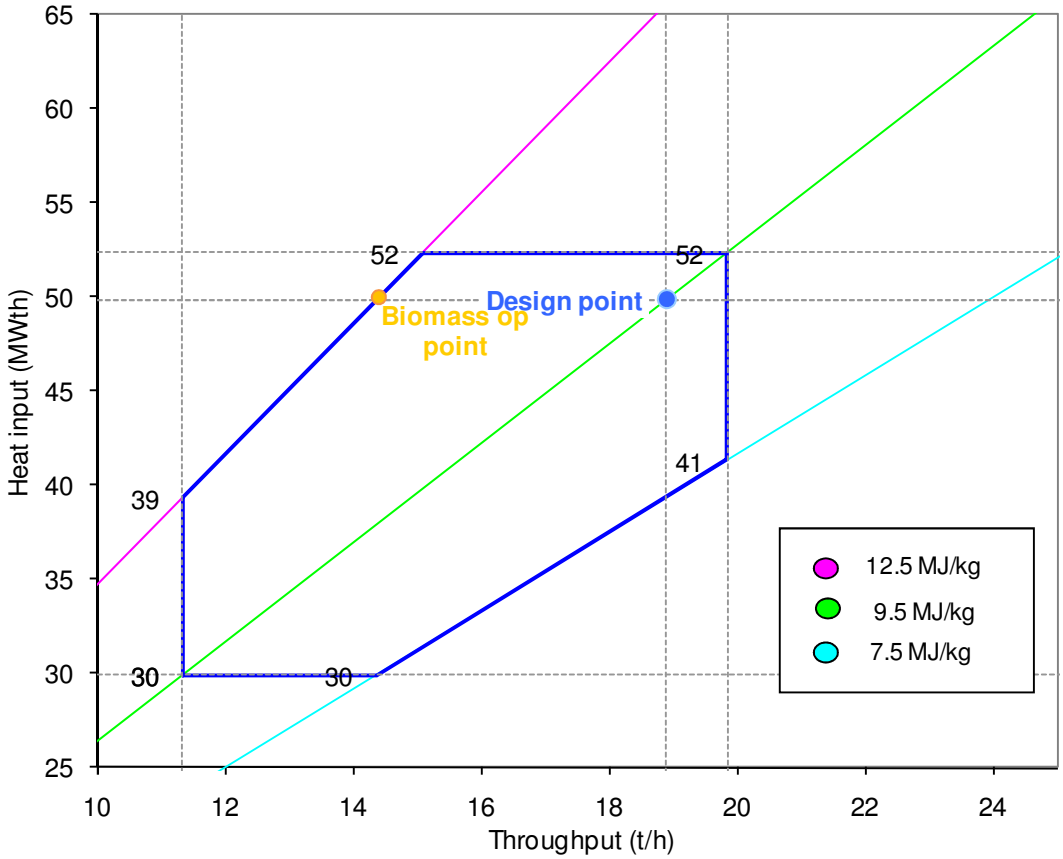
The market for waste derived biomass such as wood in the UK is very buoyant, with much of the waste wood from the construction industry thought to be being exported to mainland Europe for combustion in EfW facilities.

Interest in high biomass waste feedstocks for energy generation is driven by the renewable energy status of biomass and the enhanced revenue streams available through the Renewable Obligation Certificates (ROCs) scheme. As reported previously, there is considerable interest in converting large scale coal fired power stations to enable cofiring of biomass and coal.

The ROCs scheme also provides significant benefit to gasification and pyrolysis technologies which receive 2 ROCs for each unit of electricity derived from biomass. For these technologies high biomass feedstocks offer operational and fiscal benefits and thus market appetite for high biomass waste feedstocks is likely to be considerable amongst operators of these forms of energy technology. High biomass waste feedstocks, such as SRF, are unlikely to be of significant interest to existing incinerator operators unless sources of untreated waste are not available. Even in these cases the acceptance of biomass and indeed SRF is likely to be limited to a relative low percentage of overall throughput. The main reason for this reticence relates to the higher CV and the impact that this will have on waste throughput and hence gate fee revenue. The situation is shown in the example firing diagram below for a biomass SRF but the implications also hold true for other SRFs (Figure 14).

Figure 14 indicates that an Incineration plant designed to combust raw MSW and accepting a higher CV fuel such as SRF could need to reduce throughput by the order of 25% in order to not exceed the design rating of the boiler. Since the majority of revenue for an incineration is derived from gate fee a 25% reduction in throughput, with no additional revenue from energy sales, is likely to have a significant impact on project economics. In particular, incineration plant, unless defined as Good Quality CHP, will not derive ROCS income for generated electricity and therefore there is no benefit to be derived from higher biomass feedstocks.

Figure 14: Example Firing Diagram for Incineration showing implication of accepting high CV waste



- Green line represents untreated MSW at CV 9.5MJ/kg
- Operational envelope shows that the boiler is capable of operating in the range 7.5 – 12.5 MJ/kg

The example shows the extreme case of the impact from converting 100% untreated MSW to 100% high biomass SRF. In reality there will be an acceptable position to an existing plant operator which may be in the order of 10% SRF which would result in a very marginal increase in CV and in a minor but measurable reduction in throughput and hence gate fee. At 10% SRF (90% MSW) the combined CV would increase from 9.5 to 9.55 MJ/kg; however increasing the SRF to 20% of plant throughput would yield a CV of 10.1 MJ/kg which would have to be compensated for by a commensurate reduction in throughput. Operation under these circumstances would be technically viable but less commercially attractive.

The scenario analysis indicates that a high recycling scenario with MHT could produce in the order of 270 ktpa of SRF; applying the suggested 10% factor would require Incineration capacity in the order of 2.7 million tpa.

On this basis existing incineration plant are not expected to offer a viable long-term solution for treating high biomass waste feedstocks unless untreated residual waste feedstocks become unavailable.

In summary, there will be a continued and growing market appetite for high biomass waste feedstocks which will improve over time as a consequence of market impacts such as availability of biomass feedstocks and market price for solid fuels.

4.4 Commercial Opportunities for Thermal Facilities operating in CHP mode

To understand the potential commercial opportunities to deliver CHP enabled thermal facilities it is worth considering the situation in other geographical locations. A brief review of CHP systems has been undertaken in which waste CHP schemes in the UK and Europe have been considered. A brief synopsis is set out below with further details given in Appendix F.

4.4.1 Current Situation

There are at present only a handful of Incineration schemes currently operating in CHP mode[26] as illustrated in Table 34.

Table 34: Details of UK Thermal Facilities operating in CHP Mode

Scheme	Power Rating (MWe)	Heat Rating (MWth)	Net Energy Efficiency (%)	Scheme introduced
Nottingham	10 MWe	50 MWth	46.6% (max) 34.7% (2007)	1960's
Sheffield	20MWe	32 MWth	35%	1980's
Grimsby (industrial)	3 MWe	3 MWth	31%	Circa 2000
Shetland	heat only	15 MWth (incl. oil)	--	1998
Slough Heat and Power	50MWe	20MWth	40% estimated	1920's

Although the Ilex report was compiled in 2005, the number of CHP enabled energy from waste schemes has not dramatically changed since then.

Although examples of CHP schemes can be found in the UK there are, at present, no examples of operating schemes within London. Furthermore, the three largest schemes Nottingham, Sheffield and Slough Heat & Power have been in operation for at least 30 years; no new large scale schemes have been introduced, despite the construction of a significant number of Incineration facilities, in the period to date. Actual energy efficiencies of the existing CHP plants are in the region of 30% - 40%.

The situation in Europe is quite different to the UK; in countries such as Germany, France and Switzerland heat commands a higher value than electricity and hence most Incineration's are operated in CHP mode and some are operated in heat mode only. However, even in Switzerland where CHP is well established newer plants only deliver heat to industry and other large consumers due to economic constraints for establishing new CHP networks.

Despite a lack of Waste CHP facilities in London there is not a total absence of district heating networks. Two operating examples include the Whitehall and Pimlico district heating schemes.

The Pimlico scheme has an installed CHP capacity of 3.4MWth and 3.1MWe, supplying over 3,000 residential and 50 commercial customers.

26 Extending ROC Eligibility to Energy from Waste. Ilex Energy Consulting. 2005

The Whitehall District Heating System provides heat to 23 Government office buildings in Whitehall, amounting to 270,000m^2 of floor space via an underground network of pipes, totalling 24km in length.

In both cases the input fuel is natural gas with fuel oil backup. A project is in place at present to interconnect the two schemes to improve the operational efficiency of the existing CHP plants.

4.4.2 Future Schemes

Opportunities for new CHP schemes are likely to be based around the provision of heat to industry and other large consumers rather than retrofitting DHN network into existing conurbations. An example of large scale industrial use is the CHP plant being constructed at the Ineos Chlor site, Runcorn which will be fuelled by SRF supplied via the Greater Manchester Waste disposal contract. The capacity of the Energy from Waste CHP plant upon full completion is expected to be 750,000 tonnes of SRF, which will generate around 100MW of electricity and heat - equivalent to around 20% of Runcorn Site's total energy demand. Although no efficiency figures are available this would suggest an overall energy efficiency of between 30 and 40%.

One potential opportunity is to develop a heat network from the SELCHP plant[27]. As part of the planning approval for the new waste facility at Old Kent Road in Southwark, Veolia agreed under a S106 agreement to supply low carbon heat from SELCHP to neighbouring estates (approximately 2,700 homes) in Southwark. The first phase of work could involve providing heat to five estates in Southwark. A second phase has the potential to extend the heat network to Canada Water with further possibilities to expand to the Deptford/New Cross area in Lewisham.

The identified opportunities in Southwark (phases one and two) have a combined peak demand which is equivalent to a peak winter heat load of 40 MW. SELCHP is potentially capable of supplying a continuous heat load up to around 40 MW at the expense of some loss of electricity generation and inclusion of additional boiler plant to meet the total heat load peak heat demand.

A further example of community based CHP or District Heating is the planned redevelopment of the Brent Cross / Cricklewood area in North London. The form of heating currently proposed for this Development is biomass or SRF based CHP.

The London Heat Map[28]

The London Heat Map is an online interactive tool that provides spatial intelligence on decentralised energy, allowing users to identify opportunities for decentralised energy projects in London. Data on a range of factors is available, including major energy consumers, fuel consumption, CO_2 emissions, energy supply plant, community heating networks and energy demand density. It is publicly accessible at www.londonheatmap.org.uk.

The map allows users to upload and share energy data. It can be used and updated to assist in building detailed energy masterplans and developing decentralised energy policies.

27 Mayor's draft waste strategy (p37). http://www.london.gov.uk/sites/default/files/GLA001MWSv2.pdf
28 http://www.london.gov.uk/sites/default/files/CCMES_public_consultation_draft_Oct%202010.pdf

The map will evolve over the next three years alongside the Decentralised Energy Masterplanning Programme (DEMaP), becoming more sophisticated and more accurate at higher resolutions and providing a hub for information of use to the decentralised energy market.

Ten borough heat maps produced under the first phase of DEMaP have already been incorporated into the London Heat Map and have identified 30 new priority locations for decentralised energy projects in London.

4.4.3 Analysis

Based on the above analysis it is possible to draw the following conclusions with respect to commercial opportunities for thermal plants to operate in CHP mode:

- Opportunities to develop CHP have to be justified on economic as well as environmental benefit;
- Opportunities will be greatest where the price of or need for heat are greatest or where income can be enhanced by green tariffs;
- Retrofitting of DH networks into existing towns or cities are unlikely to be viable;
- Most significant opportunities are likely to come from industrial or large scale commercial heat users;
- Opportunities do exist within London to develop waste fuelled CHP schemes; such developments should be encouraged and supported by the GLA.

Providing that heat use opportunities can be secured, and the evidence above suggests that this can be the case, there are probable opportunities for CHP schemes to be developed in the future.

4.5 Opportunities to retrofit existing facilities

Theoretically there is no issue in retrofitting Incineration plants to be CHP enabled providing that space has been allocated for the CHP equipment and that the steam turbines have been specified so that they can be converted to CHP operation.

There are five Incineration facilities operating in or adjacent to London, as illustrated in Table 35 below and several of these plants could be retrofitted to operate in CHP mode. These facilities have been designed with turbines capable of operating in CHP mode and sufficient space has been allocated to accommodate the necessary heat transfer equipment to allow heat to be exported to a District Heating network although the equipment is not currently installed.

The cost of installing heat transfer equipment into an existing incineration plant is relatively minor (less than 2%) in comparison to the capital cost of the DHN network or the energy from waste facility.

Table 35: Existing London Thermal Facilities and CHP Potential

Scheme	Situation	CHP potential
Edmonton	Due to be decommissioned as part of NLWA's waste procurement contract	Not Applicable
SELCHP	20MWe	CHP enabled but never connected. Subject of a S106 agreement
Riverside Resource Recovery Facility	Currently electricity only	CHP potential should a suitable heat user be found
Lakeside	Electricity only	Possibility of future integration
Slough Heat and Power	CHP enabled with heat distributed to the adjacent industrial facility	Already CHP integrated

The main challenge for any CHP scheme will be identifying a suitable heat user to justify investment in the CHP retrofit.

As Table 35 indicates a number of the Incineration plants are CHP enabled and in theory retrofit to CHP operation should not be a practical issue but may present financial issues if the income received for heat does not match that lost from reduced electrical power output.

APPENDIX A - SCENARIO MODELLING

Glossary of Terms

Term	Definition
Generic	Non specific technology defined by average performance figures
MHT1	Mechanical Heat Treatment based on batch steam autoclaving
MHT 2	Mechanical Heat Treatment based on continuous heat treatment processing
MBT aerobic	Mechanical Biological Treatment with aerobic processing of the organic material. Number identification 1, 2 etc represent different technology providers or assumed technology parameters.
MBT aerobic 2 (Landfill)	Mechanical Biological Treatment with aerobic processing, SRF disposed to landfill.
MBT biostab 1	Mechanical Biological Treatment biostabilisation - A form of MBT where waste is subjected to enhanced degradation over extended time periods to produce a biologically stabilised output. Output is disposed to landfill.
MBT AD 1 (Landfill)	Mechanical Biological Treatment with anaerobic digestion of the organic material. SRF disposed to landfill.
MBT AD 2 (SRF)	Mechanical Biological Treatment with anaerobic digestion of the organic material. SRF to energy from waste.
Incineration 1 (electricity only)	Incineration producing electricity, based on high efficiency modern large Incinerator operating at circa 30% gross electricity efficiency.
CHP	Combined Heat and Power
Incineration 2 (low CHP)	Incineration Combined Heat and Power with 10% heat utilisation
Incineration 3 (medium CHP)	Incineration Combined Heat and Power with 20% heat utilisation
Incineration (high CHP)	Incineration Combined Heat and Power with 40% heat utilisation
Incineration 5 (medium efficiency electricity)	Medium efficiency Incinerator (existing plants) operating at circa 24% gross electricity efficiency)
EfW	Energy from Waste
Gasification	Representing staged combustion gasification technologies. Number identification 1, 2 etc represent different technology providers or assumed technology parameters.
Gasification Gas Engine	Representing a gasification process generating a syngas, with subsequent combustion in a gas engine. Number identification 1, 2 etc represent different technology providers or assumed technology parameters.
True Pyrolysis	Representing partial thermal degradation of waste materials to produce a syngas. Number identification 1, 2 etc represent different technology providers or assumed technology parameters.
Dirty MRF 1	Simple pretreatment of residual waste (often recovering metals/plastics only) prior to energy from waste.
AD	Anaerobic Digestion

SRF	Secondary Recovered Fuel
Fibre	High biomass SRF
CLO/digestate	Organic output from composting or anaerobic digestion technologies
Active landfill	Landfill for residual waste and rejects from pre-treatment technologies
Inert recycling	Recycling of bottom ash from thermal treatment plants
Hazardous landfill	Landfill for air pollution control residues from thermal treatment plants
Primary technology	Either waste direct to Energy from Waste treatment or processing via a Pre-treatment technology. Where waste is pretreated, the SRF outputs from pretreatment technologies (MHT, MBT, Dirty MRF) are modelled to a number of energy from waste options – incineration (electricity only), gasification (electricity only), cement kiln, power station. SRF from MHT 1 is also modelled via Gasification (CHP).
Incineration_generic	Treatment of SRF from pretreatment technologies via incineration (electricity generation) based on high efficiency modern large Incinerator operating at circa 30% gross electricity efficiency.
cement_kiln	Treatment of SRF from pretreatment technologies via a cement kiln whereby SRF utilised for heat generation will offset coal.
ATT_generic	Advanced Thermal Treatment of SRF from pretreatment technologies via gasification (electricity generation).
Power_station_generic	Treatment of SRF from pretreatment technologies via a power station generating electricity.
Gasification_CHP_generic	Treatment of SRF from pretreatment technologies via gasification with CHP, circa 26% heat recovery.

Methodology

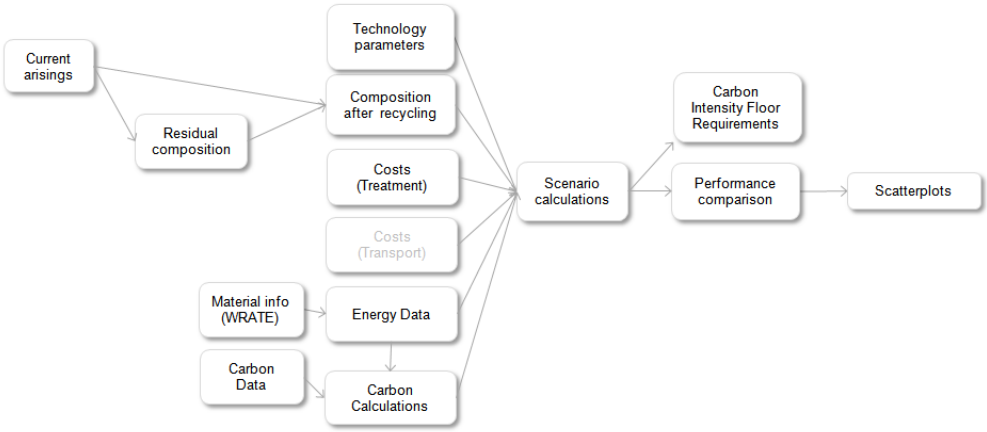
In order to satisfy the requirements of the Brief SLR has set up a Microsoft Excel based options assessment model to generate and analyse a number of potential scenarios. In total, over 400 waste management scenarios have been analysed and these cover both existing practices and future scenarios based on a range of collection, pre-treatment and energy recovery solutions

Essentially the model builds up scenarios as follows

Step 1 – Mass Balance & Waste Flow
Step 2 – Financial Model
Step 3 – Carbon Model
Step 4 – Scenario Comparison

The structure of the model is shown below.

Model Structure



Model Description

A brief overview of each worksheet is presented in the table below

Sheet 1 – Current Arisings	Sets out details of current waste tonnages.
Sheet 2 – Residual composition	Data provided to SLR on assumed recycling performance and residual composition. Output in Tabular format in accordance with GLA specification (Tables 1 and 2). Output will include tonnage and CV of materials removed in recycling and in residual waste.
Sheet 3 – Composition after Recycling	Copy of data in Sheet 2 to drive the remainder of the model
Sheet 4 – Technology Parameters	Data tables will be prepared for all of the main technology types in Sheets 3a, 3b, 4 and 5 to describe at individual material level the performance of the technology.
Sheet 5 – Material info	Provides details of carbon content and CV of waste components
Sheet 6 – Energy & Carbon	Provides details to enable carbon calculations to be undertaken. The methodology to be used for calculating carbon is discussed in more detail in Section 4.
Sheet 7 – Scenario Calculations	Characterises all of the options in terms of significant parameters, in this case cost and input fuel characteristics including biomass content and CV.
Sheet 8 – Performance Comparison	Scenarios will be ranked in terms of biomass CV content and cost (other parameters can be chosen).
Sheet 9 – Scatter plots	Graph of the key output performance against the carbon intensity floor and EPS.

Screen shots and further explanations of each of the sheets are provided in the sections below. It should be noted that the values presented in the tables below are not final figures, in some instances where information is outstanding the values included are dummy figures to ensure the model is working correctly.

Sheet 1 - Current Waste Arisings

Headline data on waste quantities are included in this sheet. The calculations work from 2009/10 data although this will be capable of being updated with waste arisings in future years.

Method	**London**		
	2007/08	**2008/09**	**2009/10**
Landfill	2,209	1,946	1,523
(percentage)	53%	*49%*	*40%*
Incineration with EfW	919	912	629
(percentage)	22%	*23%*	*16%*
Incineration without EfW	0	0	0
(percentage)	0%	*0%*	*0%*
Recycled/composted	925	994	1,061
(percentage)	22%	*25%*	*28%*
Other	101	123	613
(percentage)	2%	*3%*	*16%*
Total	**4,154**	**3,975**	**3,826**

	London		
Household waste from:	**2007/08**	**2008/09**	**2009/10**
Regular household collection	2,013	1,784	1,678
Other household sources	247	236	252
Civic amenity sites	230	190	140
Household recycling	851	911	965
Total household	**3,342**	**3,122**	**3,035**
Non household sources (excl. re	734	750	692
Non household recycling	74	83	95
Total municipal waste	**4,149**	**3,955**	**3,822**

Sheet 2 - Residual Composition

This sheet includes detailed waste compositions for the 5 scenarios developed in the previous carbon floor work. Detailed waste compositions have been aggregated to primary category level as illustrated below. The model includes the capability to include two additional user-defined compositions.

Key for compositional headings in Appendix A table excerpts:

- 0% i.e. "No change": Do Nothing New (based on 2008/09 recycling/compositing compositions and recycling performance of 25%)[29];
- Lo: 25% recycling rate, concentrating on dry recyclables only;
- Mid-d: Focus on dry recycling without food waste collections achieving 45% recycling rate;
- Mid-f: Focus on food collection achieving 45% recycling through a combination of mixed dry and food collections;
- Hi: Max GHG abatement achieving 60% recycling rate with particular emphasis on food waste collection.

Category	0%	lo	mid -d	mid -f	hi	a	b
Paper/Card	24%	20%	11%	16%	12%	0%	0%
Non-recyclable paper	0%	0%	0%	0%	0%	0%	0%
Dense plastic	6%	7%	4%	8%	8%	0%	0%
Plastic film	4%	5%	7%	7%	10%	0%	0%
Textiles	3%	4%	4%	4%	5%	0%	0%
Misc. Combustible	9%	11%	13%	13%	18%	0%	0%
Misc. Non Combustible	6%	5%	6%	6%	8%	0%	0%
Glass	5%	4%	4%	5%	5%	0%	0%
Ferrous Metal	5%	6%	4%	5%	5%	0%	0%
Non-ferrous metal	1%	1%	1%	1%	1%	0%	0%
Kitchen Organics	22%	27%	40%	29%	21%	0%	0%
Garden Organics	13%	9%	5%	6%	6%	0%	0%
Electrical / electronic equipr	0%	0%	0%	0%	0%	0%	0%
Potentially Hazardous	0%	0%	0%	0%	0%	0%	0%
Fines	2%	1%	2%	2%	2%	0%	0%
Total	**100%**	**100.00%**	**100.00%**	**100.00%**	**100%**	**0%**	**0%**

This data is combined with the waste arisings data from sheet 1 to give a tonnage breakdown of residual waste, additional recyclate removed compared to baseline and total recyclate removed.

29 Waste tonnages have been updated to 2009/10 tonnages

Residual Tonnages

	0%	lo	mid -d	mid -f	hi
Paper/Card	662,561.0	267,549.5	149,352.3	225,168.6	115,431.9
Non-recyclable paper	0.0	0.0	0.0	0.0	0.0
Dense plastic	162,879.6	96,688.7	57,340.6	107,749.4	81,598.4
Plastic film	107,666.2	64,900.6	92,011.7	95,316.8	96,524.9
Textiles	91,102.1	51,655.6	52,006.6	55,256.1	46,769.8
Misc. Combustible	259,503.1	140,397.3	173,355.3	179,582.3	179,118.5
Misc. Non Combustible	154,597.6	60,927.1	76,009.6	77,358.5	76,622.9
Glass	149,076.2	58,278.1	46,672.6	62,163.1	45,774.7
Ferrous Metal	149,076.2	83,443.7	50,673.1	62,163.1	51,745.3
Non-ferrous metal	22,085.4	11,920.5	8,001.0	9,669.8	7,960.8
Kitchen Organics	607,347.6	352,317.7	530,734.0	395,081.1	210,961.7
Garden Organics	353,365.9	117,880.7	66,675.1	85,647.0	62,691.5
Electrical / electronic equipr	0.0	0.0	0.0	0.0	0.0
Potentially Hazardous	0.0	0.0	0.0	0.0	0.0
Fines	41,410.1	18,543.0	30,670.6	26,246.6	19,902.1
Total	**2,760,670.9**	**1,324,502.5**	**1,333,502.5**	**1,381,402.5**	**995,102.5**

Recyclate removed compared to baseline

	0%	lo	mid -d	mid -f	hi
Paper/Card	0.0	395,011.5	513,208.7	437,392.4	547,129.1
Non-recyclable paper	0.0	0.0	0.0	0.0	0.0
Dense plastic	0.0	66,190.9	105,539.0	55,130.2	81,281.2
Plastic film	0.0	42,765.5	15,654.5	12,349.4	11,141.2
Textiles	0.0	39,446.5	39,095.5	35,846.0	44,332.3
Misc. Combustible	0.0	119,105.8	86,147.7	79,920.7	80,384.6
Misc. Non Combustible	0.0	93,670.5	78,587.9	77,239.0	77,974.7
Glass	0.0	90,798.1	102,403.6	86,913.1	103,301.5
Ferrous Metal	0.0	65,632.6	98,403.1	86,913.1	97,330.9
Non-ferrous metal	0.0	10,164.8	14,084.4	12,415.5	14,124.5
Kitchen Organics	0.0	255,029.9	76,613.6	212,266.5	396,385.9
Garden Organics	0.0	235,485.1	286,690.7	267,718.9	290,674.4
Electrical / electronic equipr	0.0	0.0	0.0	0.0	0.0
Potentially Hazardous	0.0	0.0	0.0	0.0	0.0
Fines	0.0	22,867.0	10,739.5	15,163.4	21,508.0
Total	**0.0**	**1,436,168.4**	**1,427,168.4**	**1,379,268.4**	**1,765,568.4**

Total Recyclate removed

	0%	lo	mid -d	mid -f	hi
Paper/Card	391,000.0	786,011.5	904,208.7	828,392.4	938,129.1
Non-recyclable paper	0.0	0.0	0.0	0.0	0.0
Dense plastic	35,095.4	101,286.3	140,634.4	90,225.6	116,376.6
Plastic film	0.0	42,765.5	15,654.5	12,349.4	11,141.2
Textiles	12,000.0	51,446.5	51,095.5	47,846.0	56,332.3
Misc. Combustible	73,806.8	192,912.6	159,954.6	153,727.6	154,191.5
Misc. Non Combustible	73,806.8	167,477.3	152,394.8	151,045.9	151,781.5
Glass	125,000.0	215,798.1	227,403.6	211,913.1	228,301.5
Ferrous Metal	62,190.8	127,823.3	160,593.9	149,103.9	159,521.7
Non-ferrous metal	15,031.8	25,196.6	29,116.1	27,447.3	29,156.3
Kitchen Organics	75,000.0	330,029.9	151,613.6	287,266.5	471,385.9
Garden Organics	198,000.0	433,485.1	484,690.7	465,718.9	488,674.4
Electrical / electronic equipr	0.0	0.0	0.0	0.0	0.0
Potentially Hazardous	0.0	0.0	0.0	0.0	0.0
Fines	0.0	22,867.0	10,739.5	15,163.4	21,508.0
Total	**1,060,931.6**	**2,497,100.0**	**2,488,100.0**	**2,440,200.0**	**2,826,500.0**

Sheet 4 – Technology parameters

This sets out details of the residual treatment technologies that can be modelled including variants for management of outputs (e.g. for AD it will be possible to model biogas to electricity, vehicle fuel and grid injection). Similarly for MHT options for managing the fibre output include Incineration, cement kiln and advanced thermal treatment.

	Secondary Outputs								
	CLO / digestate	EfW	Cement Kiln	ATT	Landfill	Biogas	Transport fuel	Grid Injection	Subtotal
MHT	0	1	1	1	0	0	0	0	**3**
MBT aerobic	0	1	1	1	0	0	0	0	**3**
MBT aerobic landfill	0	0	0	0	1	0	0	0	**1**
MBT biostab landfill	0	0	0	0	1	0	0	0	**1**
MBT anaerobic digestate to land	1	0	0	0	0	0	0	0	**1**
MBT anaerobic digestate to SRF	0	1	1	1	0	0	0	0	**3**
Incineration	0	1	0	0	0	0	0	0	**1**
Incineration with CHP	0	1	0	0	0	0	0	0	**1**
Gasification	0	0	0	1	0	0	0	0	**1**
Gasification with gas engines	0	0	0	1	0	0	0	0	**1**
True Pyrolysis	0	0	0	1	0	0	0	0	**1**
Dirty MRF	0	1	0	1	0	0	0	0	**2**
Clean MRF (assumed not to be needed at present)	0	0	0	0	0	0	0	0	**0**
Organics - AD	0	0	0	0	0	1	1	1	**3**
Organics - Aerobic	1	0	0	0	0	0	0	0	**1**

It is important to offer different options for output management as such choices could have a significant impact on the overall carbon footprint of a scenario. For example, where biogas is used to generate electricity the offset will be the marginal electricity mix, whereas for vehicle fuel the offset would be diesel or petrol. The implications in terms of carbon emissions are set out below.

Use of Biogas and Offsets Utilised for EPS

Fuel	kg CO2 per kWh useable energy	kg CO2 per kWh biogas
Diesel	0.32	0.32
Natural gas	0.23	0.23
Electricity	0.4	0.14

The emission factor for biogas to electricity takes into account the conversion efficiency of the gas engine from biogas to useable energy (nominally 35%). In the case of displacement of diesel or natural gas there is no significant conversion efficiency as the biogas is used directly (consequently emission factors are the same in both columns). Based on the biogas fuel CV input, offset of diesel is approximately twice as effective as offsetting marginal grid mix electricity.

For each technology type there may also be more than one supplier. Included within this sheet is an inclusive list of all residual treatment technologies that can be modelled (as detailed in Section 2.1).

	MHT	MBT aerobic	MBT biostabilisation	MBT AD
1	MHT_generic_parameters	MBT_aerobic_generic_parameters	MBT_aerobic_biostabilisation_generic_parameters	MBT_anaerobic_digestate_to_land_generic_parameters
2	Orchid_SRF_parameters	MBT_aerobic_generic_landfill_parameters	Generic …	MBT_anaerobic_digestate_to_SRF_generic_parameters
3	Aerothermal_SRF_parameters	Shanks_Ecodeco_parameters		Generic
4	Graphite_SRF_parameters	NewEarthSolutions_parameters		
5	Orchid_AD_parameters	ART_parameters		
6	Aerothermal_AD_parameters			

The mass balance for each treatment technology is characterised at an individual waste component level indicating how each component of the waste is partitioned across the outputs as shown below.

Shanks Ecodeco - Based on (MBT-AEROBIC) Named range **Shanks_Ecodeco_parameters**

	Outputs								
Composition	**Recycling**	**Fibre**	**SRF**	**CLO / digestate**	**Active landfill**	**Inert recycling**	**Hazardous landfill**	**Biogas**	**Losses**
Paper/Card	0%	0%	63%	0%	25%	0%	0%	0%	12%
Non-recyclable paper	0%	0%	63%	0%	25%	0%	0%	0%	12%
Dense plastic	19%	0%	69%	0%	8%	0%	0%	0%	4%
Plastic film	0%	0%	73%	0%	8%	0%	0%	0%	19%
Textiles	0%	0%	79%	0%	12%	0%	0%	0%	9%
Misc. Combustible	0%	0%	58%	0%	33%	0%	0%	0%	9%
Misc. Non Combustible	0%	0%	22%	0%	67%	0%	0%	0%	10%
Glass	0%	0%	12%	0%	87%	0%	0%	0%	1%
Ferrous Metal	89%	0%	10%	0%	0%	0%	0%	0%	1%
Non-ferrous metal	86%	0%	10%	0%	0%	0%	0%	0%	5%
Kitchen Organics	0%	0%	11%	0%	40%	0%	0%	0%	49%
Garden Organics	0%	0%	13%	0%	47%	0%	0%	0%	39%
Electrical / electronic equipment	0%	0%	23%	0%	70%	0%	0%	0%	6%
Potentially Hazardous	0%	0%	0%	0%	100%	0%	0%	0%	0%
Fines	0%	0%	0%	0%	72%	0%	0%	0%	28%
Carbon flows (based on baseline cc	3%	0%	50%	0%	27%	0%	0%	0%	20%

By adopting this compositional approach it is possible to accurately model the impact of changes in residual waste composition on the performance of the individual technologies.

For thermal technologies the characterisation tables are relatively simple as virtually all waste and carbon is converted to emissions/losses or ash.

Ethos - based on (ATT) Named range **Ethos_total_parameters**

	Outputs								
Composition	**Recycling**	**Fibre**	**SRF**	**CLO / digestate**	**Active landfill**	**Inert recycling**	**Hazardous landfill**	**Biogas**	**Losses**
Paper/Card	NA	NA	NA	NA	NA	NA	NA	NA	NA
Non-recyclable paper	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dense plastic	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plastic film	NA	NA	NA	NA	NA	NA	NA	NA	NA
Textiles	NA	NA	NA	NA	NA	NA	NA	NA	NA
Misc. Combustible	NA	NA	NA	NA	NA	NA	NA	NA	NA
Misc. Non Combustible	NA	NA	NA	NA	NA	NA	NA	NA	NA
Glass	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ferrous Metal	NA	NA	NA	NA	NA	NA	NA	NA	NA
Non-ferrous metal	NA	NA	NA	NA	NA	NA	NA	NA	NA
Kitchen Organics	NA	NA	NA	NA	NA	NA	NA	NA	NA
Garden Organics	NA	NA	NA	NA	NA	NA	NA	NA	NA
Electrical / electronic equipment	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potentially Hazardous	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fines	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	**2%**	0%	0%	0%	0%	**23%**	**4%**	0%	**71%**

Characterisation tables are available for all residual treatment technologies. The assumptions will be based on mass balance data provided through the data collection stage.

Sheet 5 – Material Info

This sheet contains specific carbon and calorific value data for individual waste components.

	Carbon (%)	Moisture (%)	Wet Basis Carbon (%)	Net CV (MJ/kg)
Paper/Card	41.53	18.20	33.97	10.75
Non-recyclable paper	41.53	18.20	33.97	10.75
Dense plastic	71.38	7.73	65.87	24.68
Plastic film	77.40	19.10	62.62	21.28
Textiles	50.30	12.40	44.06	14.33
Misc. Combustible	45.52	32.50	30.72	14.61
Misc. Non Combustible	-	-	-	2.57
Glass	-	-	-	1.41
Ferrous Metal	-	-	-	-
Non-ferrous metal	-	-	-	-
Kitchen Organics	45.40	65.40	15.71	3.46
Garden Organics	48.60	32.50	32.81	4.21
Electrical / electronic equipme	-	-	-	7.06
Potentially Hazardous	-	-	-	7.46
Fines	37.30	41.10	21.97	3.48

Data is sourced from the WRATE tool and the Engineers Handbook.

Sheet 6 – Energy & Carbon

Details of the methodology for determining carbon impacts are described in Appendix

Sheet 7 – Scenario Calculations

The scenario calculations are performed in an excel spreadsheet with almost 200 columns of information. The scenarios are set out in a number of steps.

Step 1: Scenario Names are defined

Technology type	Recycling option	Primary technology provider parameter set	Primary treatment parameter set applied to input composition (C) or input total (T)	Fibre destination type	SRF destination type	Fibre parameter set	SRF parameter set	Option name
MHT	0%	MHT_generic	C	EfW	EfW	incineration_generic	incineration_generic	0 recycling, MHT_generic, SRF to incineration_generic
MHT	lo	MHT_generic	C	EfW	EfW	incineration_generic	incineration_generic	lo recycling, MHT_generic, SRF to incineration_generic

Step 2: Headline waste arisings are defined

	Headline arisings (kt)				
Option name	Total municipal waste	Dry recyclables	Food waste	Green waste	Remainind residual
0 recycling, MHT_generic, SRF to incineration_generic	3,822	788	75	198	2,761
lo recycling, MHT_generic, SRF to incineration_generic	3,822	1,734	330	433	1,325

	Outputs from primary residual treatment (kt)								
Option name	Recycling	Fibre	SRF	CLO / digestate	Active landfill	Inert recycling	Hazardous landfill	Biogas	Losses
0 recycling, MHT_generic, SRF to incineration_generic	423	1,527	368	0	442	0	0	0	0
lo recycling, MHT_generic, SRF to incineration_generic	219	699	205	0	201	0	0	0	0

Step 3: Utilising technology parameters from Sheet 4 outputs from thermal treatment of fibre and SRF are recorded

	Outputs from secondary thermal treatment (kt)								
Option name	Recycling	Fibre	SRF	CLO / digestate	Active landfill	Inert recycling	Hazardous landfill	Biogas	Losses
0 recycling, MHT_generic, SRF to incineration_generic	38	0	0	0	0	440	68	0	1,349
lo recycling, MHT_generic, SRF to incineration_generic	18	0	0	0	0	210	33	0	644

Step 4: Costs are calculated

Collection costs are calculated

	Collection costs								
	Unit rates for collection (£/t)				Resultant overall collection costs (£M)				
Option name	Dry recyclables	Food waste	Green waste	Remaining residual	Dry recyclables	Food waste	Green waste	Remaining residual	Total collection cost
NC recycling, MHT_generic, SRF to incineration_generic	94	349	85	71	72	31	16	199	317
Io recycling, MHT_generic, SRF to incineration_generic	94	349	85	71	162	127	34	96	418

Treatment costs are calculated either on a gate fee basis

	Gate fees (£/t)				Overall gate fee costs (£M/y)				
Option name	Dry recyclables	Food waste	Green waste	Primary residual treatment process	Dry recyclables	Food waste	Green waste	Remaining residual	Total gate fee cost (£M)
NC recycling, MHT_generic, SRF to incineration_generic	4	57	38	75	3	5	7	209	224
Io recycling, MHT_generic, SRF to incineration_generic	4	57	38	75	8	21	15	101	144

or as unit Capex/Opex costs (with the option for gross costs or net costs which include electricity sales and ROCs revenue)

	Unit capex+opex (£/t)						Combined annual capex+opex (£M)						
	Treatment of segregated material			Primary residual treatment	Secondary thermal		Treatment of segregated material			Primary residual treatment	Secondary thermal		Total CAPEX+OPEX
Option name	Dry recyclables	Food waste	Green waste		Secondary thermal treatment of fibre	Secondary thermal treatment of SRF	Dry recyclables	Food waste	Green waste		Secondary thermal treatment of fibre	Secondary thermal treatment of SRF	
0 recycling, MHT_generic, SRF to incineration_generic	42	56	22	61	75	75	33	4	4	169	114	27	352
Io recycling, MHT_generic, SRF to incineration_generic	42	56	22	61	75	75	72	18	9	81	52	15	249

Both the gate fee and Capex/Opex approaches account for the sales of recyclate.

Step 5: Carbon Impacts are calculated

	Carbon emissions ($ktCO_2e$)					
Option name	Dry recyclables	Food waste	Green waste	Primary residual treatment process	Secondary thermal treatment of primary process outputs	Total carbon
0 recycling, MHT_generic, SRF to incineration_generic	-1177	-31	2	74	26	-1106
lo recycling, MHT_generic, SRF to incineration_generic	-1766	-47	3	35	12	-1763

Step 6: Key Performance Factors are compiled and assessed against the carbon floor and EPS

	Standard key perfromance indicators							
		Energy outputs (GWh)			Carbon Floor & EPS			
Option name	Total CAPEX+OPEX	Net electrical power output	Net heat output	Net combined energy recovery	Carbon performance (energy) ($kgCO_2e$/kWh) - RANDOMISED VALUE AT PRESENT	Achievement of Carbon Floor (Y/N)	Carbon perofrmance (mass) ($kgCO_2e$/tonne)	Achievment of the EPS (Y/N) -
0 recycling, MHT_generic, SRF to incineration_generic	352	1,330		1,330	349.54	Y	-0.29	N
lo recycling, MHT_generic, SRF to incineration_generic	249	535		535	367.03	Y	-0.46	Y

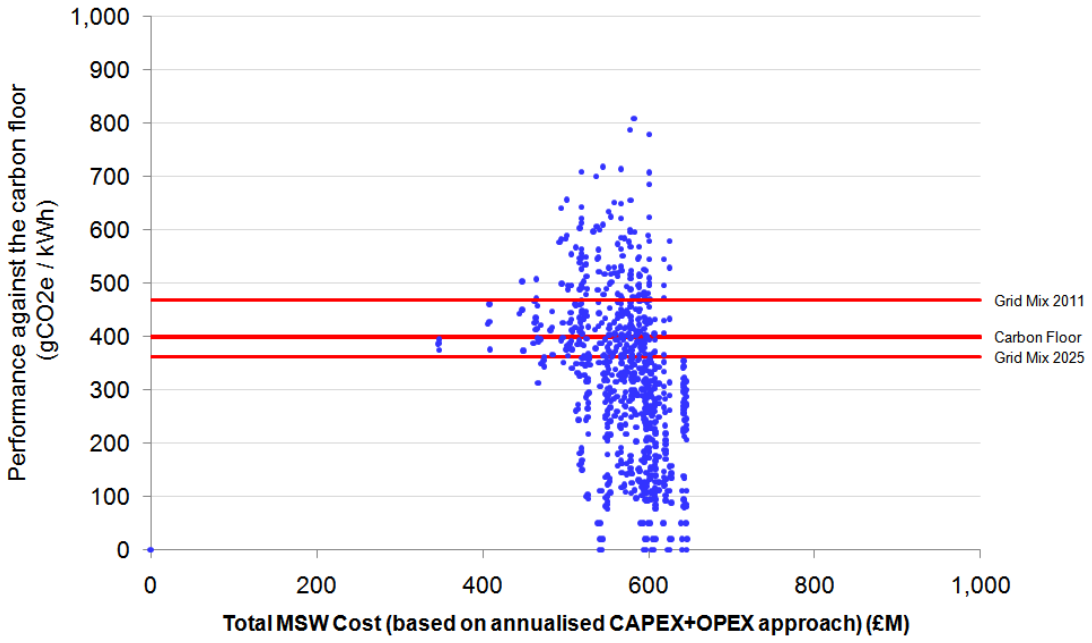
Sheet 8 – Performance Comparison

Sheet 8 records headline performance for all the scenarios against key performance indicators.

Option name	Fraction of municpal waste recycled	Fraction of municipal waste diverted	Total collection cost	Total gate fee cost	Total CAPEX+OPEX	Net electrical power output	Net heat output	Net combined energy recovery	Carbon performance (energy) (kgCO2e/kWh) - RANDOMISED VALUE AT PRESENT	Achievement of Carbon Floor (Y/N)	Carbon perofrmance (mass) (kgCO2e/tonne)	Achievment of the EPS (Y/N) -
0 recycling, MHT_generic, SRF to incineration_generic	51%	87%	282	444	352	1,330	0	1,329.92	349.54	Y	-0.29	N
lo recycling, MHT_generic, SRF to incineration_generic	77%	94%	349	221	249	535	0	534.78	367.03	Y	-0.46	Y
mid -d recycling, MHT_generic, SRF to	76%	93%	329	218	249	661	0	660.71	340.65	Y	-0.45	Y
mid -f recycling, MHT_generic, SRF to incineration_generic	76%	93%	342	230	251	668	0	668.38	401.42	N	-0.45	Y
hi recycling, MHT_generic, SRF to incineration_generic	83%	95%	373	176	223	444	0	443.65	493.61	N	-0.50	Y

Sheet 9 – Scatter plots

Scatter plots are created to show the performance of all scenarios against the carbon floor and the EPS. An example plot is given below which shows the cost and performance of each scenario relative to the carbon floor.



APPENDIX B - CARBON ASSESSMENT

Calculating performance against the Carbon Intensity Floor

The table below provides an example of how performance against the carbon intensity floor will be determined.

Category	Residual Comp	Wet Basis Carbon (%)	Net CV (MJ/kg)	Biomas Factors
Paper/Card	24%	34.0%	10.75	1
Non-recyclable paper	0%	34.0%	10.75	1
Dense plastic	6%	65.9%	24.68	0
Plastic film	4%	62.6%	21.28	0
Textiles	3%	44.1%	14.33	0.5
Misc. Combustible	9%	30.7%	14.61	0.5
Misc. Non Combustible	6%	0.0%	2.57	0
Glass	5%	0.0%	1.41	0
Ferrous Metal	5%	0.0%	-	0
Non-ferrous metal	1%	0.0%	-	0
Kitchen Organics	22%	15.7%	3.46	1
Garden Organics	13%	32.8%	4.21	1
Electrical / electronic equip	0%	0.0%	7.06	0
Potentially Hazardous	0%	0.0%	7.46	0
Fines	2%	22.0%	3.48	0.5
Totals		**26.8%**	**8.28**	
Biogenic C			**4.83**	
Non-Biogenic C			**3.46**	

		Electricity Only	CHP
Energy Generation Efficiency		26%	20%
CHP Efficiency		0%	26%
Total Efficiency (%)		26%	46%
Conversion MJ to kWh		0.2778	0.2778
Conversion factor (C to CO2)	3.67		

Outputs	Non biogenic CO2 (kg)	Energy (kWh)	Energy (kWh)
Totals	0.410	0.598	0.460
Carbon intensity (kg CO2/kWh)		0.685	0.300
Carbon floor achieved		No	Yes

CO2 content determined by CV

Data Inputs to the EPS Calculation

Data for the carbon impacts of recycling is drawn from WRATE.

Material list	Reprocessing option list	tCO_2e / t
Non-ferrous	Non-ferrous scrap recycling	-10.72
Ferrous	Ferrous metal recycling	-1.62
Paper	Paper recycling mixed European Ave	-0.30
Card	Corrugated cardboard recycling (Eur	-0.06
Wood	Wood chipping recycling	0.00
Textile	Textiles Recycling	-4.37
Glass - Clear	Shot blast	-0.04
Glass - Clear	Construction aggregate	-0.03
Glass - Clear	Colour seperated	-0.16
Glass - Green	Shot blast	-0.04
Glass - Green	Construction aggregate	-0.03
Glass - Green	Colour seperated	-0.16
Glass - Brown	Shot blast	-0.04
Glass - Brown	Construction aggregate	-0.03
Glass - Brown	Colour seperated	-0.16
Glass - Mixed	Shot blast	-0.04
Glass - Mixed	Construction aggregate	-0.03
Glass - Mixed	Colour seperated	-0.16
Dense Plastic	Mixed dense plastics recycling	-0.68
Dense Plastic	LDPE PVC recycling	-0.70
Dense Plastic	PET recycling	-1.23
Dense Plastic	PP, PS recycling	-1.07
Film Plastic	LLDPE, plastic film recycling	-0.64
C + D	Construction + Demolition (Building r	-0.01
Re-use	Furniture re-use	0.00

The carbon impacts / burdens for treatment processes will be derived in the manner described in 4.1. Example data is set out below.

Technology Type ↓ Carbon factor type →	**Capital burdens** Construction materials tCO2e per t	**Indirect burdens (material)** Operational material inputs, maintenance etc tCO2e per t	**Indirect burdens (electricity)** Electricity inputs to facility MJ per t	**Indirect burdens (heat)** Heat inputs to the facility MJ per t	**Direct emissions** Direct release from process waste tech dependent (see below)
MHT	0.001	0.001	1,560.00	0.00	0.044
MBT aerobic	0.004	0.010	216.00	0.00	0.447
MBT biostabilised	0.007	0.011	264.00	0.00	0.421
MBT anaerobic	0.003	0.047	180.00	0.00	0.359
Incineration	0.003	0.024	45.00	0.00	0.000
Gasification	0.003	0.007	14.50	0.00	0.000
Gasification (Gas Engines)	0.003	0.007	14.50	0.00	0.000
True Pyrolysis	0.004	0.032	0.31	0.00	0.000
Dirty MRF	0.001	0.001	75.00	0.00	0.044
Landfill	0.001	0.001	0.00	0.00	0.289

For those impacts not identified above the following approaches will be used:

Avoided burdens (recyclables)	Calculated using carbon factors per tonne of recyclate from the Recycling Module.
Avoided burdens (Electricity)	Calculated using energy content of waste/SRF, the assumed electrical efficiency factor and the carbon conversion factor from the Energy Module.
Avoided burdens (heat)	Calculated using energy content of waste/SRF, the assumed heat efficiency factor and the carbon conversion factor.

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MHT 1	incineration_generic	30%	0%	-	70%	341.91	-0.21	2020	641.10	83.05	84.71
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MHT 1	incineration_generic	30%	0%	-	64%	330.37	-0.35	2031	602.59	109.48	48.20
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	322.82	-0.36	2031	547.78	96.27	47.06
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	375.12	-0.33	2031	591.76	105.12	49.73
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MHT 1	incineration_generic	30%	0%	-	55%	343.48	-0.37	2031	612.17	119.76	40.43
NC recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	NC	MHT 1	cement_kiln	0%	100%	-	70%	94.37	-0.43	2031	641.10	83.05	84.71
lo recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	lo	MHT 1	cement_kiln	0%	100%	-	64%	107.71	-0.46	2031	602.59	109.48	48.20
mid -d recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	97.77	-0.45	2031	547.78	96.27	47.06
mid -f recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	118.73	-0.44	2031	591.76	105.12	49.73
hi recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	hi	MHT 1	cement_kiln	0%	100%	-	55%	126.76	-0.44	2031	612.17	119.76	40.43
NC recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	NC	MHT 1	ATT_generic	30%	0%	-	70%	310.23	-0.23	2020	641.10	83.05	84.71
lo recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	lo	MHT 1	ATT_generic	30%	0%	-	64%	300.11	-0.36	2031	602.59	109.48	48.20
mid -d recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	293.12	-0.37	2031	547.78	96.27	47.06
mid -f recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	340.53	-0.34	2031	591.76	105.12	49.73
hi recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	hi	MHT 1	ATT_generic	30%	0%	-	55%	312.16	-0.38	2031	612.17	119.76	40.43
NC recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	NC	MHT 1	power_station_generic	36%	0%	-	70%	255.67	-0.41	2031	641.10	83.05	84.71
lo recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	lo	MHT 1	power_station_generic	36%	0%	-	64%	257.06	-0.45	2031	602.59	109.48	48.20
mid -d recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	246.97	-0.44	2031	547.78	96.27	47.06
mid -f recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	289.82	-0.43	2031	591.76	105.12	49.73

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
NC recycling, MHT 1, SRF to Gasification 1	52%	70%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	hi	MHT 1	power_station_generic	36%	0%	-	55%	274.35	-0.44	2031	612.17	119.76	40.43
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MHT 2	incineration_generic	30%	0%	-	70%	296.61	-0.23	2020	641.10	83.05	84.71
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MHT 2	incineration_generic	30%	0%	-	64%	294.49	-0.36	2031	602.59	109.48	48.20
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	276.88	-0.37	2031	547.78	96.27	47.06
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	332.15	-0.34	2031	591.76	105.12	49.73
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MHT 2	incineration_generic	30%	0%	-	55%	313.65	-0.38	2031	612.17	119.76	40.43
NC recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	NC	MHT 2	cement_kiln	0%	100%	-	70%	81.57	-0.46	2031	641.10	83.05	84.71
lo recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	lo	MHT 2	cement_kiln	0%	100%	-	64%	93.88	-0.48	2031	602.59	109.48	48.20
mid -d recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	82.40	-0.47	2031	547.78	96.27	47.06
mid -f recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	103.06	-0.46	2031	591.76	105.12	49.73
hi recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	hi	MHT 2	cement_kiln	0%	100%	-	55%	112.19	-0.46	2031	612.17	119.76	40.43
NC recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	NC	MHT 2	ATT_generic	30%	0%	-	70%	269.14	-0.24	2031	641.10	83.05	84.71
lo recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	lo	MHT 2	ATT_generic	30%	0%	-	64%	267.59	-0.37	2031	602.59	109.48	48.20
mid -d recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	251.48	-0.38	2031	547.78	96.27	47.06
mid -f recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	301.61	-0.35	2031	591.76	105.12	49.73
hi recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	hi	MHT 2	ATT_generic	30%	0%	-	55%	285.16	-0.38	2031	612.17	119.76	40.43
NC recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	NC	MHT 2	power_station_generic	36%	0%	-	70%	221.61	-0.46	2031	641.10	83.05	84.71
lo recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	lo	MHT 2	power_station_generic	36%	0%	-	64%	228.07	-0.47	2031	602.59	109.48	48.20
mid -d recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	211.01	-0.46	2031	547.78	96.27	47.06

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
NC recycling, MHT 2, SRF to Gasification 1	52%	70%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	255.54	-0.46	2031	591.76	105.12	49.73
hi recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	hi	MHT 2	power_station_generic	36%	0%	-	55%	249.04	-0.46	2031	612.17	119.76	40.43
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MBT aerobic 1	incineration_generic	30%	0%	-	50%	546.55	-0.12	-	587.44	83.05	70.67
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT aerobic 1	incineration_generic	30%	0%	-	43%	494.54	-0.31	2031	573.64	109.48	40.62
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT aerobic 1	incineration_generic	30%	0%	-	40%	603.78	-0.31	2031	516.98	96.27	39.00
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MBT aerobic 1	incineration_generic	30%	0%	-	38%	573.79	-0.28	2031	562.45	105.12	42.06
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT aerobic 1	incineration_generic	30%	0%	-	33%	526.04	-0.32	2031	594.56	119.76	35.82
NC recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	151.21	-0.29	2031	587.44	83.05	70.67
lo recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	161.96	-0.39	2031	573.64	109.48	40.62
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	181.72	-0.38	2031	516.98	96.27	39.00
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	179.87	-0.38	2031	562.45	105.12	42.06
hi recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	184.75	-0.40	2031	594.56	119.76	35.82
NC recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with electricity generation	NC	MBT aerobic 1	ATT_generic	30%	0%	-	50%	495.79	-0.14	2015	587.44	83.05	70.67
lo recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with electricity generation	lo	MBT aerobic 1	ATT_generic	30%	0%	-	43%	448.58	-0.32	2031	573.64	109.48	40.62
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MBT aerobic 1	ATT_generic	30%	0%	-	40%	547.52	-0.32	2031	516.98	96.27	39.00
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	520.31	-0.29	2031	562.45	105.12	42.06
hi recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with electricity generation	hi	MBT aerobic 1	ATT_generic	30%	0%	-	33%	477.02	-0.33	2031	594.56	119.76	35.82
NC recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with electricity generation	NC	MBT aerobic 1	power_station_generic	36%	0%	-	50%	408.85	-0.31	2031	587.44	83.05	70.67
lo recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with electricity generation	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	384.71	-0.41	2031	573.64	109.48	40.62

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	39%	50%
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	71%	43%
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	38%
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	78%	33%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
NC recycling, MBT aerobic 1, SRF to Gasification 1	39%	50%
lo recycling, MBT aerobic 1, SRF to Gasification 1	71%	43%
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	69%	40%
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	69%	38%
hi recycling, MBT aerobic 1, SRF to Gasification 1	78%	33%
NC recycling, MBT aerobic 1, SRF to power_station_generic	38%	50%
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MBT aerobic 1	power_station_generic	36%	0%	-	40%	460.75	-0.39	2031	516.98	96.27	39.00
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	441.95	-0.39	2031	562.45	105.12	42.06
hi recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with electricity generation	hi	MBT aerobic 1	power_station_generic	36%	0%	-	33%	415.22	-0.42	2031	594.56	119.76	35.82
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MBT aerobic 3	incineration_generic	30%	0%	-	50%	476.19	-0.14	2015	587.44	83.05	70.67
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT aerobic 3	incineration_generic	30%	0%	-	43%	443.17	-0.32	2031	573.64	109.48	40.62
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT aerobic 3	incineration_generic	30%	0%	-	40%	539.45	-0.31	2031	516.98	96.27	39.00
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MBT aerobic 3	incineration_generic	30%	0%	-	38%	512.89	-0.29	2031	562.45	105.12	42.06
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT aerobic 3	incineration_generic	30%	0%	-	33%	482.22	-0.33	2031	594.56	119.76	35.82
NC recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	131.24	-0.33	2031	587.44	83.05	70.67
lo recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	141.96	-0.41	2031	573.64	109.48	40.62
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	160.33	-0.40	2031	516.98	96.27	39.00
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	158.01	-0.39	2031	562.45	105.12	42.06
hi recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	165.19	-0.42	2031	594.56	119.76	35.82
NC recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with electricity generation	NC	MBT aerobic 3	ATT_generic	30%	0%	-	50%	431.99	-0.16	2015	587.44	83.05	70.67
lo recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with electricity generation	lo	MBT aerobic 3	ATT_generic	30%	0%	-	43%	402.11	-0.33	2031	573.64	109.48	40.62
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MBT aerobic 3	ATT_generic	30%	0%	-	40%	489.28	-0.32	2031	516.98	96.27	39.00
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MBT aerobic 3	ATT_generic	30%	0%	-	38%	465.20	-0.30	2031	562.45	105.12	42.06
hi recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with electricity generation	hi	MBT aerobic 3	ATT_generic	30%	0%	-	33%	437.44	-0.34	2031	594.56	119.76	35.82
NC recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	355.89	-0.36	2031	587.44	83.05	70.67

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	69%	40%
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	68%	38%
hi recycling, MBT aerobic 1, SRF to power_station_generic	78%	33%
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	39%	50%
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	71%	43%
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	38%
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	78%	33%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
NC recycling, MBT aerobic 3, SRF to Gasification 1	39%	50%
lo recycling, MBT aerobic 3, SRF to Gasification 1	71%	43%
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	69%	40%
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	69%	38%
hi recycling, MBT aerobic 3, SRF to Gasification 1	78%	33%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	343.17	-0.43	2031	573.64	109.48	40.62
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MBT aerobic 3	power_station_generic	36%	0%	-	40%	410.52	-0.41	2031	516.98	96.27	39.00
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	393.58	-0.42	2031	562.45	105.12	42.06
hi recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	378.77	-0.44	2031	594.56	119.76	35.82
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	297.22	-0.27	2031	644.33	83.05	85.55
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	261.19	-0.39	2031	602.15	109.48	48.08
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	372.74	-0.38	2031	551.30	96.27	47.99
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	316.24	-0.37	2031	594.06	105.12	50.33
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	283.08	-0.40	2031	619.41	119.76	42.32
NC recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	83.65	-0.38	2031	644.33	83.05	85.55
lo recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	95.67	-0.44	2031	602.15	109.48	48.08
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	123.14	-0.41	2031	551.30	96.27	47.99
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	111.45	-0.42	2031	594.06	105.12	50.33
hi recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	121.76	-0.43	2031	619.41	119.76	42.32
NC recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	269.76	-0.28	2031	644.33	83.05	85.55
lo recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	237.83	-0.39	2031	602.15	109.48	48.08
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	338.44	-0.38	2031	551.30	96.27	47.99
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	287.47	-0.38	2031	594.06	105.12	50.33
hi recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	257.92	-0.40	2031	619.41	119.76	42.32

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	69%	40%
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	223.37	-0.39	2031	644.33	83.05	85.55
lo recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	208.65	-0.44	2031	602.15	109.48	48.08
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	290.75	-0.42	2031	551.30	96.27	47.99
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	250.30	-0.43	2031	594.06	105.12	50.33
hi recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	233.17	-0.44	2031	619.41	119.76	42.32
NC recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	NC	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.10	-	644.86	83.05	85.69
lo recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.31	2031	601.99	109.48	48.04
mid -d recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.32	2031	541.67	96.27	45.47
mid -f recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.30	2031	592.98	105.12	50.05
hi recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.35	2031	618.64	119.76	42.12
NC recycling, MBT biostab 1	Wet AD with electricity generation	NC	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.11	-	638.82	83.05	84.11
lo recycling, MBT biostab 1	Wet AD with electricity generation	lo	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.31	2031	598.98	109.48	47.25
mid -d recycling, MBT biostab 1	Wet AD with electricity generation	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.32	2031	538.79	96.27	44.71
mid -f recycling, MBT biostab 1	Wet AD with electricity generation	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.30	2031	590.46	105.12	49.39
hi recycling, MBT biostab 1	Wet AD with electricity generation	hi	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.35	2031	617.16	119.76	41.73
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	61%	364.98	-0.18	2015	579.37	83.05	68.56
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	361.72	-0.33	2031	570.68	109.48	39.85
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	385.84	-0.35	2031	514.12	96.27	38.26
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	406.11	-0.32	2031	559.00	105.12	41.16

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
NC recycling, MBT aerobic 2 (landfill)	33%	0%
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%
hi recycling, MBT aerobic 2 (landfill)	75%	0%
NC recycling, MBT biostab 1	32%	0%
lo recycling, MBT biostab 1	67%	0%
mid -d recycling, MBT biostab 1	66%	0%
mid -f recycling, MBT biostab 1	65%	0%
hi recycling, MBT biostab 1	75%	0%
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	41%	61%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	51%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	380.12	-0.36	2031	590.64	119.76	34.79
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	68%	314.51	-0.19	2020	595.27	83.05	72.72
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	320.03	-0.34	2031	578.64	109.48	41.93
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	316.54	-0.35	2031	524.39	96.27	40.94
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	359.47	-0.32	2031	567.22	105.12	43.31
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	351.45	-0.36	2031	595.36	119.76	36.03
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	94.15	-0.48	2031	595.27	83.05	72.72
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	106.84	-0.48	2031	578.64	109.48	41.93
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	100.44	-0.49	2031	524.39	96.27	40.94
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	117.54	-0.47	2031	567.22	105.12	43.31
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	127.09	-0.47	2031	595.36	119.76	36.03
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	NC	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	68%	284.93	-0.21	2020	595.27	83.05	72.72
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	290.25	-0.35	2031	578.64	109.48	41.93
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	286.92	-0.36	2031	524.39	96.27	40.94
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	325.84	-0.33	2031	567.22	105.12	43.31
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	318.79	-0.37	2031	595.36	119.76	36.03
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	239.52	-0.46	2031	595.27	83.05	72.72
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	249.97	-0.47	2031	578.64	109.48	41.93
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	244.39	-0.47	2031	524.39	96.27	40.94

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	46%	68%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	46%	68%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	279.38	-0.46	2031	567.22	105.12	43.31
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	279.12	-0.47	2031	595.36	119.76	36.03
NC recycling, Incineration 1 (electricity only)_total	Wet AD with electricity generation	NC	Incineration 1 (electricity only)_total	#N/A	30%	0%	62%		426.58	-0.12	-	462.63	83.05	38.01
lo recycling, Incineration 1 (electricity only)_total	Wet AD with electricity generation	lo	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		427.56	-0.29	2031	517.33	109.48	25.89
mid -d recycling, Incineration 1 (electricity only)_total	Wet AD with electricity generation	mid -d	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		467.15	-0.31	2031	462.76	96.27	24.82
mid -f recycling, Incineration 1 (electricity only)_total	Wet AD with electricity generation	mid -f	Incineration 1 (electricity only)_total	#N/A	30%	0%	52%		488.88	-0.27	2031	502.60	105.12	26.40
hi recycling, Incineration 1 (electricity only)_total	Wet AD with electricity generation	hi	Incineration 1 (electricity only)_total	#N/A	30%	0%	47%		490.19	-0.30	2031	548.75	119.76	23.83
NC recycling, Incineration 2 (low CHP)_total	Wet AD with electricity generation	NC	Incineration 2 (low CHP)_total	#N/A	22%	10%	62%		403.07	-0.13	-	585.07	83.05	70.05
lo recycling, Incineration 2 (low CHP)_total	Wet AD with electricity generation	lo	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		407.08	-0.29	2031	576.54	109.48	41.38
mid -d recycling, Incineration 2 (low CHP)_total	Wet AD with electricity generation	mid -d	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		442.94	-0.32	2031	522.36	96.27	40.41
mid -f recycling, Incineration 2 (low CHP)_total	Wet AD with electricity generation	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		464.59	-0.28	2031	564.32	105.12	42.55
hi recycling, Incineration 2 (low CHP)_total	Wet AD with electricity generation	hi	Incineration 2 (low CHP)_total	#N/A	22%	10%	47%		468.45	-0.31	2031	593.46	119.76	35.53
NC recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	NC	Incineration 3 (medium CHP)_total	#N/A	20%	20%	62%		323.31	-0.19	2015	579.71	83.05	68.64
lo recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		335.20	-0.32	2031	573.94	109.48	40.70
mid -d recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		359.53	-0.34	2031	519.75	96.27	39.73
mid -f recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		380.06	-0.31	2031	561.61	105.12	41.84
hi recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		390.85	-0.34	2031	591.50	119.76	35.02
NC recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		231.63	-0.30	2031	564.91	83.05	64.77
lo recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		247.72	-0.38	2031	566.79	109.48	38.83

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
NC recycling, Incineration 1 (electricity only)_total	46%	62%
lo recycling, Incineration 1 (electricity only)_total	74%	57%
mid -d recycling, Incineration 1 (electricity only)_total	74%	57%
mid -f recycling, Incineration 1 (electricity only)_total	73%	52%
hi recycling, Incineration 1 (electricity only)_total	80%	47%
NC recycling, Incineration 2 (low CHP)_total	46%	62%
lo recycling, Incineration 2 (low CHP)_total	74%	57%
mid -d recycling, Incineration 2 (low CHP)_total	74%	57%
mid -f recycling, Incineration 2 (low CHP)_total	73%	52%
hi recycling, Incineration 2 (low CHP)_total	80%	47%
NC recycling, Incineration 3 (medium CHP)_total	46%	62%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%
NC recycling, Incineration 4 (high CHP)_total	46%	62%
lo recycling, Incineration 4 (high CHP)_total	74%	57%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		261.17	-0.40	2031	512.55	96.27	37.85
mid -f recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		278.65	-0.37	2031	554.16	105.12	39.89
hi recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		293.58	-0.39	2031	586.10	119.76	33.60
NC recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with electricity generation	NC	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	62%		535.09	-0.07	-	523.68	83.05	53.98
lo recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with electricity generation	lo	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		518.20	-0.27	2031	546.85	109.48	33.61
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with electricity generation	mid -d	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		576.74	-0.29	2031	492.48	96.27	32.59
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with electricity generation	mid -f	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	52%		597.49	-0.24	2031	533.37	105.12	34.45
hi recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with electricity generation	hi	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	47%		584.50	-0.29	2031	571.04	119.76	29.66
NC recycling, Gasification 1_total	Wet AD with electricity generation	NC	Gasification 1_total	#N/A	30%	0%	62%		387.00	-0.15	2015	346.30	83.05	7.57
lo recycling, Gasification 1_total	Wet AD with electricity generation	lo	Gasification 1_total	#N/A	30%	0%	57%		387.95	-0.30	2031	461.08	109.48	11.17
mid -d recycling, Gasification 1_total	Wet AD with electricity generation	mid -d	Gasification 1_total	#N/A	30%	0%	57%		423.79	-0.33	2031	406.13	96.27	10.00
mid -f recycling, Gasification 1_total	Wet AD with electricity generation	mid -f	Gasification 1_total	#N/A	30%	0%	52%		443.48	-0.29	2031	443.97	105.12	11.06
hi recycling, Gasification 1_total	Wet AD with electricity generation	hi	Gasification 1_total	#N/A	30%	0%	47%		444.65	-0.32	2031	506.28	119.76	12.72
NC recycling, Gasification 2_total	Wet AD with electricity generation	NC	Gasification 2_total	#N/A	21%	0%	62%		546.44	-0.08	-	538.39	83.05	57.83
lo recycling, Gasification 2_total	Wet AD with electricity generation	lo	Gasification 2_total	#N/A	21%	0%	57%		518.15	-0.27	2031	553.96	109.48	35.47
mid -d recycling, Gasification 2_total	Wet AD with electricity generation	mid -d	Gasification 2_total	#N/A	21%	0%	57%		583.11	-0.30	2031	499.64	96.27	34.47
mid -f recycling, Gasification 2_total	Wet AD with electricity generation	mid -f	Gasification 2_total	#N/A	21%	0%	52%		600.30	-0.25391	2031	540.79	105.12	36.39
hi recycling, Gasification 2_total	Wet AD with electricity generation	hi	Gasification 2_total	#N/A	21%	0%	47%		578.67	-0.29	2031	576.41	119.76	31.07
NC recycling, Gasification Gas Engine 1_total	Wet AD with electricity generation	NC	Gasification Gas Engine 1_total	#N/A	30%	0%	62%		375.97	-0.15	2015	500.87	83.05	48.02

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
NC recycling, Incineration 5 (medium efficiency electricity)_total	46%	62%
lo recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	73%	52%
hi recycling, Incineration 5 (medium efficiency electricity)_total	80%	47%
NC recycling, Gasification 1_total	46%	62%
lo recycling, Gasification 1_total	74%	57%
mid -d recycling, Gasification 1_total	74%	57%
mid -f recycling, Gasification 1_total	73%	52%
hi recycling, Gasification 1_total	80%	47%
NC recycling, Gasification 2_total	46%	62%
lo recycling, Gasification 2_total	74%	57%
mid -d recycling, Gasification 2_total	74%	57%
mid -f recycling, Gasification 2_total	73%	52%
hi recycling, Gasification 2_total	80%	47%
NC recycling, Gasification Gas Engine 1_total	46%	62%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, Gasification Gas Engine 1_total	Wet AD with electricity generation	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		378.40	-0.31	2031	535.82	109.48	30.73
mid -d recycling, Gasification Gas Engine 1_total	Wet AD with electricity generation	mid -d	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		412.47	-0.33	2031	481.38	96.27	29.69
mid -f recycling, Gasification Gas Engine 1_total	Wet AD with electricity generation	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		432.13	-0.29	2031	521.88	105.12	31.44
hi recycling, Gasification Gas Engine 1_total	Wet AD with electricity generation	hi	Gasification Gas Engine 1_total	#N/A	30%	0%	47%		434.53	-0.32	2031	562.71	119.76	27.49
NC recycling, Gasification Gas Engine 2_total	Wet AD with electricity generation	NC	Gasification Gas Engine 2_total	#N/A	32%	0%	62%		354.94	-0.17	2015	472.77	83.05	40.66
lo recycling, Gasification Gas Engine 2_total	Wet AD with electricity generation	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		359.96	-0.31	2031	522.23	109.48	27.17
mid -d recycling, Gasification Gas Engine 2_total	Wet AD with electricity generation	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		390.75	-0.34	2031	467.70	96.27	26.11
mid -f recycling, Gasification Gas Engine 2_total	Wet AD with electricity generation	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		410.31	-0.30	2031	507.72	105.12	27.74
hi recycling, Gasification Gas Engine 2_total	Wet AD with electricity generation	hi	Gasification Gas Engine 2_total	#N/A	32%	0%	47%		414.91	-0.33	2031	552.46	119.76	24.80
NC recycling, True Pyrolysis 1_total	Wet AD with electricity generation	NC	True Pyrolysis 1_total	#N/A	32%	0%	62%		357.60	-0.14	2015	527.76	83.05	55.05
lo recycling, True Pyrolysis 1_total	Wet AD with electricity generation	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		362.13	-0.30	2031	548.83	109.48	34.13
mid -d recycling, True Pyrolysis 1_total	Wet AD with electricity generation	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		393.41	-0.33	2031	494.47	96.27	33.11
mid -f recycling, True Pyrolysis 1_total	Wet AD with electricity generation	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		412.92	-0.29	2031	535.43	105.12	34.99
hi recycling, True Pyrolysis 1_total	Wet AD with electricity generation	hi	True Pyrolysis 1_total	#N/A	32%	0%	47%		417.10	-0.32	2031	572.53	119.76	30.05
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	363.91	-0.27	2031	544.89	83.05	59.53
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	362.17	-0.37	2031	555.70	109.48	35.93
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	Dirty MRF 1	incineration_generic	30%	0%	-	61%	426.49	-0.36	2031	504.93	96.27	35.85
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	426.71	-0.35	2031	543.92	105.12	37.21
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	Dirty MRF 1	incineration_generic	30%	0%	-	52%	437.73	-0.37	2031	578.08	119.76	31.51

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, Gasification Gas Engine 1_total	74%	57%
mid -d recycling, Gasification Gas Engine 1_total	74%	57%
mid -f recycling, Gasification Gas Engine 1_total	73%	52%
hi recycling, Gasification Gas Engine 1_total	80%	47%
NC recycling, Gasification Gas Engine 2_total	46%	62%
lo recycling, Gasification Gas Engine 2_total	74%	57%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
mid -f recycling, Gasification Gas Engine 2_total	73%	52%
hi recycling, Gasification Gas Engine 2_total	80%	47%
NC recycling, True Pyrolysis 1_total	46%	62%
lo recycling, True Pyrolysis 1_total	74%	57%
mid -d recycling, True Pyrolysis 1_total	74%	57%
mid -f recycling, True Pyrolysis 1_total	73%	52%
hi recycling, True Pyrolysis 1_total	80%	47%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	61%
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	58%
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	82%	52%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	330.16	-0.28	2031	544.89	83.05	59.53
lo recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	328.77	-0.38	2031	555.70	109.48	35.93
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	386.95	-0.37	2031	504.93	96.27	35.85
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	387.18	-0.36	2031	543.92	105.12	37.21
hi recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	397.20	-0.38	2031	578.08	119.76	31.51
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	138.20	-0.38	2031	641.10	83.05	84.71
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	151.83	-0.44	2031	602.59	109.48	48.20
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	136.26	-0.43	2031	547.78	96.27	47.06
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	168.14	-0.42	2031	591.76	105.12	49.73
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	174.38	-0.43	2031	612.17	119.76	40.43
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MHT 1	incineration_generic	30%	0%	-	70%	344.17	-0.21	2020	642.20	83.05	85.00
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MHT 1	incineration_generic	30%	0%	-	64%	345.16	-0.33	2031	607.14	109.48	49.39
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	332.31	-0.35	2031	549.88	96.27	47.62
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	387.85	-0.31	2031	595.57	105.12	50.73
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MHT 1	incineration_generic	30%	0%	-	55%	366.40	-0.34	2031	618.31	119.76	42.03
NC recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	NC	MHT 1	cement_kiln	0%	100%	-	70%	95.06	-0.42	2031	642.20	83.05	85.00
lo recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	lo	MHT 1	cement_kiln	0%	100%	-	64%	113.06	-0.44	2031	607.14	109.48	49.39
mid -d recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	100.97	-0.44	2031	549.88	96.27	47.62
mid -f recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	123.21	-0.42	2031	595.57	105.12	50.73

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
NC recycling, MHT 2, SRF to Gasification_CHP_generic		
lo recycling, MHT 2, SRF to Gasification_CHP_generic		
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic		
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic		
hi recycling, MHT 2, SRF to Gasification_CHP_generic		
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	hi	MHT 1	cement_kiln	0%	100%	-	55%	136.14	-0.41	2031	618.31	119.76	42.03
NC recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	NC	MHT 1	ATT_generic	30%	0%	-	70%	312.51	-0.22	2020	642.20	83.05	85.00
lo recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	lo	MHT 1	ATT_generic	30%	0%	-	64%	315.03	-0.34	2031	607.14	109.48	49.39
mid -d recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	302.71	-0.36	2031	549.88	96.27	47.62
mid -f recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	353.39	-0.32	2031	595.57	105.12	50.73
hi recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	hi	MHT 1	ATT_generic	30%	0%	-	55%	335.24	-0.35	2031	618.31	119.76	42.03
NC recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	NC	MHT 1	power_station_generic	36%	0%	-	70%	257.56	-0.40	2031	642.20	83.05	85.00
lo recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	lo	MHT 1	power_station_generic	36%	0%	-	64%	269.90	-0.43	2031	607.14	109.48	49.39
mid -d recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	255.09	-0.43	2031	549.88	96.27	47.62
mid -f recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	300.81	-0.41	2031	595.57	105.12	50.73
hi recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	hi	MHT 1	power_station_generic	36%	0%	-	55%	294.73	-0.41	2031	618.31	119.76	42.03
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MHT 2	incineration_generic	30%	0%	-	70%	298.57	-0.23	2020	642.20	83.05	85.00
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MHT 2	incineration_generic	30%	0%	-	64%	307.67	-0.34	2031	607.14	109.48	49.39
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	285.01	-0.36	2031	549.88	96.27	47.62
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	343.42	-0.32	2031	595.57	105.12	50.73
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MHT 2	incineration_generic	30%	0%	-	55%	334.57	-0.35	2031	618.31	119.76	42.03
NC recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	NC	MHT 2	cement_kiln	0%	100%	-	70%	82.17	-0.46	2031	642.20	83.05	85.00
lo recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	lo	MHT 2	cement_kiln	0%	100%	-	64%	98.55	-0.45	2031	607.14	109.48	49.39
mid -d recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	85.09	-0.46	2031	549.88	96.27	47.62

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
NC recycling, MHT 1, SRF to Gasification 1	52%	70%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	106.95	-0.44	2031	595.57	105.12	50.73
hi recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	hi	MHT 2	cement_kiln	0%	100%	-	55%	120.49	-0.43	2031	618.31	119.76	42.03
NC recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	NC	MHT 2	ATT_generic	30%	0%	-	70%	271.12	-0.24	2020	642.20	83.05	85.00
lo recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	lo	MHT 2	ATT_generic	30%	0%	-	64%	280.90	-0.35	2031	607.14	109.48	49.39
mid -d recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	259.70	-0.37	2031	549.88	96.27	47.62
mid -f recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	313.00	-0.33	2031	595.57	105.12	50.73
hi recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	hi	MHT 2	ATT_generic	30%	0%	-	55%	306.25	-0.35	2031	618.31	119.76	42.03
NC recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	NC	MHT 2	power_station_generic	36%	0%	-	70%	223.24	-0.45	2031	642.20	83.05	85.00
lo recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	lo	MHT 2	power_station_generic	36%	0%	-	64%	239.46	-0.45	2031	607.14	109.48	49.39
mid -d recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	217.94	-0.45	2031	549.88	96.27	47.62
mid -f recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	265.23	-0.44	2031	595.57	105.12	50.73
hi recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	hi	MHT 2	power_station_generic	36%	0%	-	55%	267.54	-0.43	2031	618.31	119.76	42.03
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MBT aerobic 1	incineration_generic	30%	0%	-	50%	549.03	-0.12	-	588.54	83.05	70.96
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT aerobic 1	incineration_generic	30%	0%	-	43%	509.74	-0.28	2031	578.19	109.48	41.81
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT aerobic 1	incineration_generic	30%	0%	-	40%	612.89	-0.30	2031	519.08	96.27	39.55
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MBT aerobic 1	incineration_generic	30%	0%	-	38%	585.91	-0.26	2031	566.26	105.12	43.06
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT aerobic 1	incineration_generic	30%	0%	-	33%	545.95	-0.29	2031	600.70	119.76	37.43
NC recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	151.97	-0.29	2031	588.54	83.05	70.96
lo recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	167.50	-0.37	2031	578.19	109.48	41.81

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
NC recycling, MHT 2, SRF to Gasification 1	52%	70%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	39%	50%
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	71%	43%
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	38%
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	78%	33%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	184.78	-0.37	2031	519.08	96.27	39.55
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	184.10	-0.36	2031	566.26	105.12	43.06
hi recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	192.52	-0.37	2031	600.70	119.76	37.43
NC recycling, MBT aerobic 1, SRF to Gasification 1	Dry AD with electricity generation	NC	MBT aerobic 1	ATT_generic	30%	0%	-	50%	498.29	-0.14	2015	588.54	83.05	70.96
lo recycling, MBT aerobic 1, SRF to Gasification 1	Dry AD with electricity generation	lo	MBT aerobic 1	ATT_generic	30%	0%	-	43%	463.92	-0.29	2031	578.19	109.48	41.81
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MBT aerobic 1	ATT_generic	30%	0%	-	40%	556.72	-0.31	2031	519.08	96.27	39.55
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	532.54	-0.27	2031	566.26	105.12	43.06
hi recycling, MBT aerobic 1, SRF to Gasification 1	Dry AD with electricity generation	hi	MBT aerobic 1	ATT_generic	30%	0%	-	33%	497.10	-0.30	2031	600.70	119.76	37.43
NC recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	NC	MBT aerobic 1	power_station_generic	36%	0%	-	50%	410.92	-0.31	2031	588.54	83.05	70.96
lo recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	397.93	-0.38	2031	578.19	109.48	41.81
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MBT aerobic 1	power_station_generic	36%	0%	-	40%	468.54	-0.38	2031	519.08	96.27	39.55
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	452.39	-0.37	2031	566.26	105.12	43.06
hi recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	hi	MBT aerobic 1	power_station_generic	36%	0%	-	33%	432.77	-0.39	2031	600.70	119.76	37.43
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MBT aerobic 3	incineration_generic	30%	0%	-	50%	478.34	-0.14	2015	588.54	83.05	70.96
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT aerobic 3	incineration_generic	30%	0%	-	43%	456.79	-0.29	2031	578.19	109.48	41.81
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT aerobic 3	incineration_generic	30%	0%	-	40%	547.59	-0.30	2031	519.08	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MBT aerobic 3	incineration_generic	30%	0%	-	38%	523.72	-0.27	2031	566.26	105.12	43.06
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT aerobic 3	incineration_generic	30%	0%	-	33%	500.48	-0.30	2031	600.70	119.76	37.43
NC recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	131.90	-0.32	2031	588.54	83.05	70.96

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
NC recycling, MBT aerobic 1, SRF to Gasification 1	39%	50%
lo recycling, MBT aerobic 1, SRF to Gasification 1	71%	43%
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	69%	40%
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	69%	38%
hi recycling, MBT aerobic 1, SRF to Gasification 1	78%	33%
NC recycling, MBT aerobic 1, SRF to power_station_generic	38%	50%
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	69%	40%
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	68%	38%
hi recycling, MBT aerobic 1, SRF to power_station_generic	78%	33%
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	39%	50%
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	71%	43%
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	38%
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	78%	33%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	146.81	-0.39	2031	578.19	109.48	41.81
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	163.02	-0.39	2031	519.08	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	161.73	-0.38	2031	566.26	105.12	43.06
hi recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	172.14	-0.39	2031	600.70	119.76	37.43
NC recycling, MBT aerobic 3, SRF to Gasification 1	Dry AD with electricity generation	NC	MBT aerobic 3	ATT_generic	30%	0%	-	50%	434.16	-0.15	2015	588.54	83.05	70.96
lo recycling, MBT aerobic 3, SRF to Gasification 1	Dry AD with electricity generation	lo	MBT aerobic 3	ATT_generic	30%	0%	-	43%	415.86	-0.30	2031	578.19	109.48	41.81
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MBT aerobic 3	ATT_generic	30%	0%	-	40%	497.51	-0.31	2031	519.08	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MBT aerobic 3	ATT_generic	30%	0%	-	38%	476.14	-0.28	2031	566.26	105.12	43.06
hi recycling, MBT aerobic 3, SRF to Gasification 1	Dry AD with electricity generation	hi	MBT aerobic 3	ATT_generic	30%	0%	-	33%	455.84	-0.31	2031	600.70	119.76	37.43
NC recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	357.70	-0.35	2031	588.54	83.05	70.96
lo recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	354.96	-0.41	2031	578.19	109.48	41.81
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MBT aerobic 3	power_station_generic	36%	0%	-	40%	417.46	-0.40	2031	519.08	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	402.87	-0.40	2031	566.26	105.12	43.06
hi recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	394.78	-0.41	2031	600.70	119.76	37.43
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	301.04	-0.27	2031	645.43	83.05	85.84
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	283.52	-0.37	2031	606.69	109.48	49.27
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	388.48	-0.37	2031	553.40	96.27	48.54
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	336.21	-0.35	2031	597.87	105.12	51.33
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	314.66	-0.37	2031	625.55	119.76	43.93

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
NC recycling, MBT aerobic 3, SRF to Gasification 1	39%	50%
lo recycling, MBT aerobic 3, SRF to Gasification 1	71%	43%
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	69%	40%
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	69%	38%
hi recycling, MBT aerobic 3, SRF to Gasification 1	78%	33%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	69%	40%
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	84.84	-0.38	2031	645.43	83.05	85.84
lo recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	104.72	-0.42	2031	606.69	109.48	49.27
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	128.91	-0.40	2031	553.40	96.27	48.54
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	119.26	-0.40	2031	597.87	105.12	51.33
hi recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	136.76	-0.40	2031	625.55	119.76	43.93
NC recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	273.62	-0.27	2031	645.43	83.05	85.84
lo recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	260.33	-0.37	2031	606.69	109.48	49.27
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	354.32	-0.37	2031	553.40	96.27	48.54
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	307.61	-0.36	2031	597.87	105.12	51.33
hi recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	289.69	-0.37	2031	625.55	119.76	43.93
NC recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	226.58	-0.38	2031	645.43	83.05	85.84
lo recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	228.47	-0.42	2031	606.69	109.48	49.27
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	304.45	-0.41	2031	553.40	96.27	48.54
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	267.92	-0.41	2031	597.87	105.12	51.33
hi recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	262.01	-0.41	2031	625.55	119.76	43.93
NC recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	NC	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.09	-	645.97	83.05	85.98
lo recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.29	2031	606.53	109.48	49.23
mid -d recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.31	2031	543.77	96.27	46.02
mid -f recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.28	2031	596.79	105.12	51.05

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
NC recycling, MBT aerobic 2 (landfill)	33%	0%
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.32	2031	624.78	119.76	43.73
NC recycling, MBT biostab 1	Dry AD with electricity generation	NC	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.10	-	639.92	83.05	84.40
lo recycling, MBT biostab 1	Dry AD with electricity generation	lo	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.29	2031	603.52	109.48	48.44
mid -d recycling, MBT biostab 1	Dry AD with electricity generation	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.31	2031	540.89	96.27	45.26
mid -f recycling, MBT biostab 1	Dry AD with electricity generation	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.28	2031	594.27	105.12	50.39
hi recycling, MBT biostab 1	Dry AD with electricity generation	hi	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.32	2031	623.30	119.76	43.34
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	61%	366.70	-0.18	2015	580.47	83.05	68.84
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	373.44	-0.31	2031	575.22	109.48	41.04
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	393.02	-0.34	2031	516.22	96.27	38.81
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	415.70	-0.30	2031	562.81	105.12	42.15
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	397.09	-0.33	2031	596.78	119.76	36.40
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	68%	315.99	-0.19	2015	596.37	83.05	73.00
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	330.39	-0.32	2031	583.18	109.48	43.12
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	322.44	-0.34	2031	526.49	96.27	41.49
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	367.96	-0.30	2031	571.03	105.12	44.30
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	367.14	-0.33	2031	601.50	119.76	37.63
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	94.65	-0.48	2031	596.37	83.05	73.00
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	110.69	-0.46	2031	583.18	109.48	43.12
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	102.52	-0.48	2031	526.49	96.27	41.49

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT aerobic 2 (landfill)	75%	0%
NC recycling, MBT biostab 1	32%	0%
lo recycling, MBT biostab 1	67%	0%
mid -d recycling, MBT biostab 1	66%	0%
mid -f recycling, MBT biostab 1	65%	0%
hi recycling, MBT biostab 1	75%	0%
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	41%	61%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	51%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	46%	68%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	120.63	-0.46	2031	571.03	105.12	44.30
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	133.39	-0.44	2031	601.50	119.76	37.63
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	NC	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	68%	286.43	-0.21	2020	596.37	83.05	73.00
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	300.71	-0.33	2031	583.18	109.48	43.12
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	292.86	-0.35	2031	526.49	96.27	41.49
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	334.41	-0.32	2031	571.03	105.12	44.30
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	334.60	-0.34	2031	601.50	119.76	37.63
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	240.79	-0.45	2031	596.37	83.05	73.00
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	259.02	-0.45	2031	583.18	109.48	43.12
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	249.48	-0.46	2031	526.49	96.27	41.49
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	286.76	-0.45	2031	571.03	105.12	44.30
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	293.03	-0.44	2031	601.50	119.76	37.63
NC recycling, Incineration 1 (electricity only)_total	Dry AD with electricity generation	NC	Incineration 1 (electricity only)_total	#N/A	30%	0%	62%		427.90	-0.11	-	463.73	83.05	38.30
lo recycling, Incineration 1 (electricity only)_total	Dry AD with electricity generation	lo	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		436.93	-0.27	2031	521.88	109.48	27.08
mid -d recycling, Incineration 1 (electricity only)_total	Dry AD with electricity generation	mid -d	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		472.15	-0.30	2031	464.86	96.27	25.37
mid -f recycling, Incineration 1 (electricity only)_total	Dry AD with electricity generation	mid -f	Incineration 1 (electricity only)_total	#N/A	30%	0%	52%		496.27	-0.25	2031	506.42	105.12	27.40
hi recycling, Incineration 1 (electricity only)_total	Dry AD with electricity generation	hi	Incineration 1 (electricity only)_total	#N/A	30%	0%	47%		503.48	-0.28	2031	554.89	119.76	25.44
NC recycling, Incineration 2 (low CHP)_total	Dry AD with electricity generation	NC	Incineration 2 (low CHP)_total	#N/A	22%	10%	62%		404.32	-0.12	-	586.17	83.05	70.33
lo recycling, Incineration 2 (low CHP)_total	Dry AD with electricity generation	lo	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		416.01	-0.27	2031	581.08	109.48	42.57

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	46%	68%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
NC recycling, Incineration 1 (electricity only)_total	46%	62%
lo recycling, Incineration 1 (electricity only)_total	74%	57%
mid -d recycling, Incineration 1 (electricity only)_total	74%	57%
mid -f recycling, Incineration 1 (electricity only)_total	73%	52%
hi recycling, Incineration 1 (electricity only)_total	80%	47%
NC recycling, Incineration 2 (low CHP)_total	46%	62%
lo recycling, Incineration 2 (low CHP)_total	74%	57%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, Incineration 2 (low CHP)_total	Dry AD with electricity generation	mid -d	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		447.68	-0.31	2031	524.46	96.27	40.96
mid -f recycling, Incineration 2 (low CHP)_total	Dry AD with electricity generation	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		471.61	-0.26	2031	568.13	105.12	43.55
hi recycling, Incineration 2 (low CHP)_total	Dry AD with electricity generation	hi	Incineration 2 (low CHP)_total	#N/A	22%	10%	47%		481.16	-0.28	2031	599.60	119.76	37.14
NC recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	NC	Incineration 3 (medium CHP)_total	#N/A	20%	20%	62%		324.31	-0.18	2015	580.81	83.05	68.93
lo recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		342.55	-0.30	2031	578.49	109.48	41.89
mid -d recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		363.38	-0.33	2031	521.86	96.27	40.28
mid -f recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		385.80	-0.29	2031	565.43	105.12	42.84
hi recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		401.45	-0.31	2031	597.64	119.76	36.62
NC recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		232.35	-0.29	2031	566.01	83.05	65.06
lo recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		253.15	-0.36	2031	571.33	109.48	40.02
mid -d recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		263.96	-0.39	2031	514.65	96.27	38.40
mid -f recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		282.86	-0.35	2031	557.97	105.12	40.89
hi recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		301.55	-0.36	2031	592.24	119.76	35.21
NC recycling, Incineration 5 (medium efficiency electricity)_total	Dry AD with electricity generation	NC	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	62%		536.74	-0.07	-	524.78	83.05	54.27
lo recycling, Incineration 5 (medium efficiency electricity)_total	Dry AD with electricity generation	lo	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		529.56	-0.24	2031	551.40	109.48	34.80
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	Dry AD with electricity generation	mid -d	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		582.92	-0.28	2031	494.58	96.27	33.14
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	Dry AD with electricity generation	mid -f	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	52%		606.52	-0.23	2020	537.18	105.12	35.45
hi recycling, Incineration 5 (medium efficiency electricity)_total	Dry AD with electricity generation	hi	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	47%		600.35	-0.26	2031	577.18	119.76	31.27
NC recycling, Gasification 1_total	Dry AD with electricity generation	NC	Gasification 1_total	#N/A	30%	0%	62%		388.33	-0.14	2015	347.40	83.05	7.86

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, Incineration 2 (low CHP)_total	74%	57%
mid -f recycling, Incineration 2 (low CHP)_total	73%	52%
hi recycling, Incineration 2 (low CHP)_total	80%	47%
NC recycling, Incineration 3 (medium CHP)_total	46%	62%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%
NC recycling, Incineration 4 (high CHP)_total	46%	62%
lo recycling, Incineration 4 (high CHP)_total	74%	57%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
NC recycling, Incineration 5 (medium efficiency electricity)_total	46%	62%
lo recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	73%	52%
hi recycling, Incineration 5 (medium efficiency electricity)_total	80%	47%
NC recycling, Gasification 1_total	46%	62%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, Gasification 1_total	Dry AD with electricity generation	lo	Gasification 1_total	#N/A	30%	0%	57%		397.43	-0.28	2031	465.62	109.48	12.36
mid -d recycling, Gasification 1_total	Dry AD with electricity generation	mid -d	Gasification 1_total	#N/A	30%	0%	57%		428.85	-0.32	2031	408.23	96.27	10.55
mid -f recycling, Gasification 1_total	Dry AD with electricity generation	mid -f	Gasification 1_total	#N/A	30%	0%	52%		450.95	-0.27	2031	447.78	105.12	12.05
hi recycling, Gasification 1_total	Dry AD with electricity generation	hi	Gasification 1_total	#N/A	30%	0%	47%		458.07	-0.29	2031	512.42	119.76	14.32
NC recycling, Gasification 2_total	Dry AD with electricity generation	NC	Gasification 2_total	#N/A	21%	0%	62%		548.32	-0.08	-	539.49	83.05	58.12
lo recycling, Gasification 2_total	Dry AD with electricity generation	lo	Gasification 2_total	#N/A	21%	0%	57%		530.80	-0.25	2031	558.51	109.48	36.66
mid -d recycling, Gasification 2_total	Dry AD with electricity generation	mid -d	Gasification 2_total	#N/A	21%	0%	57%		590.08	-0.29	2031	501.74	96.27	35.02
mid -f recycling, Gasification 2_total	Dry AD with electricity generation	mid -f	Gasification 2_total	#N/A	21%	0%	52%		610.41	-0.23567	2020	544.60	105.12	37.39
hi recycling, Gasification 2_total	Dry AD with electricity generation	hi	Gasification 2_total	#N/A	21%	0%	47%		596.14	-0.26	2031	582.55	119.76	32.68
NC recycling, Gasification Gas Engine 1_total	Dry AD with electricity generation	NC	Gasification Gas Engine 1_total	#N/A	30%	0%	62%		377.26	-0.15	2015	501.97	83.05	48.30
lo recycling, Gasification Gas Engine 1_total	Dry AD with electricity generation	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		387.64	-0.29	2031	540.37	109.48	31.92
mid -d recycling, Gasification Gas Engine 1_total	Dry AD with electricity generation	mid -d	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		417.39	-0.32	2031	483.48	96.27	30.24
mid -f recycling, Gasification Gas Engine 1_total	Dry AD with electricity generation	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		439.41	-0.27	2031	525.69	105.12	32.44
hi recycling, Gasification Gas Engine 1_total	Dry AD with electricity generation	hi	Gasification Gas Engine 1_total	#N/A	30%	0%	47%		447.65	-0.29	2031	568.85	119.76	29.09
NC recycling, Gasification Gas Engine 2_total	Dry AD with electricity generation	NC	Gasification Gas Engine 2_total	#N/A	32%	0%	62%		356.16	-0.16	2015	473.88	83.05	40.95
lo recycling, Gasification Gas Engine 2_total	Dry AD with electricity generation	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		368.75	-0.29	2031	526.78	109.48	28.36
mid -d recycling, Gasification Gas Engine 2_total	Dry AD with electricity generation	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		395.41	-0.33	2031	469.80	96.27	26.66
mid -f recycling, Gasification Gas Engine 2_total	Dry AD with electricity generation	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		417.22	-0.28	2031	511.53	105.12	28.73
hi recycling, Gasification Gas Engine 2_total	Dry AD with electricity generation	hi	Gasification Gas Engine 2_total	#N/A	32%	0%	47%		427.43	-0.30	2031	558.59	119.76	26.41

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, Gasification 1_total	74%	57%
mid -d recycling, Gasification 1_total	74%	57%
mid -f recycling, Gasification 1_total	73%	52%
hi recycling, Gasification 1_total	80%	47%
NC recycling, Gasification 2_total	46%	62%
lo recycling, Gasification 2_total	74%	57%
mid -d recycling, Gasification 2_total	74%	57%
mid -f recycling, Gasification 2_total	73%	52%
hi recycling, Gasification 2_total	80%	47%
NC recycling, Gasification Gas Engine 1_total	46%	62%
lo recycling, Gasification Gas Engine 1_total	74%	57%
mid -d recycling, Gasification Gas Engine 1_total	74%	57%
mid -f recycling, Gasification Gas Engine 1_total	73%	52%
hi recycling, Gasification Gas Engine 1_total	80%	47%
NC recycling, Gasification Gas Engine 2_total	46%	62%
lo recycling, Gasification Gas Engine 2_total	74%	57%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
mid -f recycling, Gasification Gas Engine 2_total	73%	52%
hi recycling, Gasification Gas Engine 2_total	80%	47%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, True Pyrolysis 1_total	Dry AD with electricity generation	NC	True Pyrolysis 1_total	#N/A	32%	0%	62%		358.83	-0.14	2015	528.86	83.05	55.34
lo recycling, True Pyrolysis 1_total	Dry AD with electricity generation	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		371.01	-0.28	2031	553.37	109.48	35.32
mid -d recycling, True Pyrolysis 1_total	Dry AD with electricity generation	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		398.13	-0.32	2031	496.57	96.27	33.66
mid -f recycling, True Pyrolysis 1_total	Dry AD with electricity generation	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		419.91	-0.27	2031	539.24	105.12	35.99
hi recycling, True Pyrolysis 1_total	Dry AD with electricity generation	hi	True Pyrolysis 1_total	#N/A	32%	0%	47%		429.75	-0.29	2031	578.67	119.76	31.66
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	365.36	-0.26	2031	545.99	83.05	59.82
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	372.59	-0.35	2031	560.24	109.48	37.12
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	Dirty MRF 1	incineration_generic	30%	0%	-	61%	431.88	-0.35	2031	507.03	96.27	36.40
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	434.97	-0.33	2031	547.73	105.12	38.21
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	Dirty MRF 1	incineration_generic	30%	0%	-	52%	452.33	-0.34	2031	584.22	119.76	33.11
NC recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	331.63	-0.28	2031	545.99	83.05	59.82
lo recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	339.29	-0.36	2031	560.24	109.48	37.12
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	392.40	-0.36	2031	507.03	96.27	36.40
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	395.52	-0.34	2031	547.73	105.12	38.21
hi recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	411.94	-0.35	2031	584.22	119.76	33.11
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	139.21	-0.38	2031	642.20	83.05	85.00
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	159.38	-0.41	2031	607.14	109.48	49.39
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	140.72	-0.42	2031	549.88	96.27	47.62
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	174.49	-0.40	2031	595.57	105.12	50.73

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, True Pyrolysis 1_total	46%	62%
lo recycling, True Pyrolysis 1_total	74%	57%
mid -d recycling, True Pyrolysis 1_total	74%	57%
mid -f recycling, True Pyrolysis 1_total	73%	52%
hi recycling, True Pyrolysis 1_total	80%	47%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	61%
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	58%
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	82%	52%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
NC recycling, MHT 2, SRF to Gasification_CHP_generic	52%	70%
lo recycling, MHT 2, SRF to Gasification_CHP_generic	77%	64%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	76%	70%
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	76%	61%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	187.28	-0.40	2031	618.31	119.76	42.03
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MHT 1	incineration_generic	30%	0%	-	70%	323.64	-0.21	2020	642.63	83.05	85.11
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MHT 1	incineration_generic	30%	0%	-	64%	241.17	-0.33	2031	608.92	109.48	49.85
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	260.91	-0.35	2031	550.71	96.27	47.83
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	284.50	-0.31	2031	597.07	105.12	51.12
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MHT 1	incineration_generic	30%	0%	-	55%	218.34	-0.34	2031	620.72	119.76	42.66
NC recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MHT 1	cement_kiln	0%	100%	-	70%	92.76	-0.42	2031	642.63	83.05	85.11
lo recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MHT 1	cement_kiln	0%	100%	-	64%	94.98	-0.44	2031	608.92	109.48	49.85
mid -d recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	90.53	-0.44	2031	550.71	96.27	47.83
mid -f recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	106.76	-0.42	2031	597.07	105.12	51.12
hi recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MHT 1	cement_kiln	0%	100%	-	55%	102.68	-0.41	2031	620.72	119.76	42.66
NC recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MHT 1	ATT_generic	30%	0%	-	70%	293.47	-0.22	2020	642.63	83.05	85.11
lo recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MHT 1	ATT_generic	30%	0%	-	64%	218.53	-0.34	2031	608.92	109.48	49.85
mid -d recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	236.44	-0.36	2031	550.71	96.27	47.83
mid -f recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	257.67	-0.32	2031	597.07	105.12	51.12
hi recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MHT 1	ATT_generic	30%	0%	-	55%	197.88	-0.35	2031	620.72	119.76	42.66
NC recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MHT 1	power_station_generic	36%	0%	-	70%	244.12	-0.40	2031	642.63	83.05	85.11
lo recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MHT 1	power_station_generic	36%	0%	-	64%	194.57	-0.43	2031	608.92	109.48	49.85
mid -d recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	205.31	-0.43	2031	550.71	96.27	47.83

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MHT 2, SRF to Gasification_CHP_generic	84%	55%
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
NC recycling, MHT 1, SRF to Gasification 1	52%	70%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	227.32	-0.41	2031	597.07	105.12	51.12
hi recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MHT 1	power_station_generic	36%	0%	-	55%	181.72	-0.41	2031	620.72	119.76	42.66
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MHT 2	incineration_generic	30%	0%	-	70%	282.76	-0.23	2020	642.63	83.05	85.11
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MHT 2	incineration_generic	30%	0%	-	64%	221.47	-0.34	2031	608.92	109.48	49.85
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	230.06	-0.36	2031	550.71	96.27	47.83
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	259.08	-0.32	2031	597.07	105.12	51.12
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MHT 2	incineration_generic	30%	0%	-	55%	205.89	-0.35	2031	620.72	119.76	42.66
NC recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MHT 2	cement_kiln	0%	100%	-	70%	80.36	-0.46	2031	642.63	83.05	85.11
lo recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MHT 2	cement_kiln	0%	100%	-	64%	84.06	-0.45	2031	608.92	109.48	49.85
mid -d recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	77.20	-0.46	2031	550.71	96.27	47.83
mid -f recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	93.92	-0.44	2031	597.07	105.12	51.12
hi recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MHT 2	cement_kiln	0%	100%	-	55%	92.91	-0.43	2031	620.72	119.76	42.66
NC recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MHT 2	ATT_generic	30%	0%	-	70%	256.43	-0.24	2020	642.63	83.05	85.11
lo recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MHT 2	ATT_generic	30%	0%	-	64%	200.77	-0.35	2031	608.92	109.48	49.85
mid -d recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	208.58	-0.37	2031	550.71	96.27	47.83
mid -f recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	234.75	-0.33	2031	597.07	105.12	51.12
hi recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MHT 2	ATT_generic	30%	0%	-	55%	186.68	-0.35	2031	620.72	119.76	42.66
NC recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MHT 2	power_station_generic	36%	0%	-	70%	212.88	-0.45	2031	642.63	83.05	85.11
lo recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MHT 2	power_station_generic	36%	0%	-	64%	177.49	-0.45	2031	608.92	109.48	49.85

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
NC recycling, MHT 2, SRF to Gasification 1	52%	70%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	179.83	-0.45	2031	550.71	96.27	47.83
mid -f recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	205.68	-0.44	2031	597.07	105.12	51.12
hi recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MHT 2	power_station_generic	36%	0%	-	55%	170.26	-0.43	2031	620.72	119.76	42.66
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MBT aerobic 1	incineration_generic	30%	0%	-	50%	514.74	-0.12	-	588.97	83.05	71.07
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT aerobic 1	incineration_generic	30%	0%	-	43%	358.28	-0.28	2031	579.97	109.48	42.28
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 1	incineration_generic	30%	0%	-	40%	491.70	-0.30	2031	519.91	96.27	39.77
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 1	incineration_generic	30%	0%	-	38%	440.31	-0.26	2031	567.76	105.12	43.45
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT aerobic 1	incineration_generic	30%	0%	-	33%	351.16	-0.29	2031	603.11	119.76	38.06
NC recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	148.38	-0.29	2031	588.97	83.05	71.07
lo recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	142.25	-0.37	2031	579.97	109.48	42.28
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	168.82	-0.37	2031	519.91	96.27	39.77
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	162.65	-0.36	2031	567.76	105.12	43.45
hi recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	154.67	-0.37	2031	603.11	119.76	38.06
NC recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MBT aerobic 1	ATT_generic	30%	0%	-	50%	466.61	-0.14	2015	588.97	83.05	71.07
lo recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MBT aerobic 1	ATT_generic	30%	0%	-	43%	324.16	-0.29	2031	579.97	109.48	42.28
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 1	ATT_generic	30%	0%	-	40%	445.02	-0.31	2031	519.91	96.27	39.77
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	398.36	-0.27	2031	567.76	105.12	43.45
hi recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MBT aerobic 1	ATT_generic	30%	0%	-	33%	317.57	-0.30	2031	603.11	119.76	38.06
NC recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MBT aerobic 1	power_station_generic	36%	0%	-	50%	388.71	-0.31	2031	588.97	83.05	71.07

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	39%	50%
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	71%	43%
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	38%
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	78%	33%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
NC recycling, MBT aerobic 1, SRF to Gasification 1	39%	50%
lo recycling, MBT aerobic 1, SRF to Gasification 1	71%	43%
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	69%	40%
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	69%	38%
hi recycling, MBT aerobic 1, SRF to Gasification 1	78%	33%
NC recycling, MBT aerobic 1, SRF to power_station_generic	38%	50%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	289.12	-0.38	2031	579.97	109.48	42.28
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 1	power_station_generic	36%	0%	-	40%	385.67	-0.38	2031	519.91	96.27	39.77
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	350.42	-0.37	2031	567.76	105.12	43.45
hi recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MBT aerobic 1	power_station_generic	36%	0%	-	33%	288.55	-0.39	2031	603.11	119.76	38.06
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MBT aerobic 3	incineration_generic	30%	0%	-	50%	451.85	-0.14	2015	588.97	83.05	71.07
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT aerobic 3	incineration_generic	30%	0%	-	43%	330.52	-0.29	2031	579.97	109.48	42.28
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 3	incineration_generic	30%	0%	-	40%	448.18	-0.30	2031	519.91	96.27	39.77
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 3	incineration_generic	30%	0%	-	38%	403.54	-0.27	2031	567.76	105.12	43.45
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT aerobic 3	incineration_generic	30%	0%	-	33%	331.08	-0.30	2031	603.11	119.76	38.06
NC recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	129.10	-0.32	2031	588.97	83.05	71.07
lo recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	126.58	-0.39	2031	579.97	109.48	42.28
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	150.20	-0.39	2031	519.91	96.27	39.77
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	144.57	-0.38	2031	567.76	105.12	43.45
hi recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	140.72	-0.39	2031	603.11	119.76	38.06
NC recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MBT aerobic 3	ATT_generic	30%	0%	-	50%	409.66	-0.15	2015	588.97	83.05	71.07
lo recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MBT aerobic 3	ATT_generic	30%	0%	-	43%	299.18	-0.30	2031	579.97	109.48	42.28
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 3	ATT_generic	30%	0%	-	40%	405.77	-0.31	2031	519.91	96.27	39.77
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 3	ATT_generic	30%	0%	-	38%	365.24	-0.28	2031	567.76	105.12	43.45
hi recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MBT aerobic 3	ATT_generic	30%	0%	-	33%	299.52	-0.31	2031	603.11	119.76	38.06

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	69%	40%
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	68%	38%
hi recycling, MBT aerobic 1, SRF to power_station_generic	78%	33%
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	39%	50%
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	71%	43%
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	38%
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	78%	33%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
NC recycling, MBT aerobic 3, SRF to Gasification 1	39%	50%
lo recycling, MBT aerobic 3, SRF to Gasification 1	71%	43%
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	69%	40%
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	69%	38%
hi recycling, MBT aerobic 3, SRF to Gasification 1	78%	33%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	340.54	-0.35	2031	588.97	83.05	71.07
lo recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	265.01	-0.41	2031	579.97	109.48	42.28
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 3	power_station_generic	36%	0%	-	40%	349.84	-0.40	2031	519.91	96.27	39.77
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	319.30	-0.40	2031	567.76	105.12	43.45
hi recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	270.46	-0.41	2031	603.11	119.76	38.06
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	271.32	-0.27	2031	645.86	83.05	85.96
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	167.59	-0.37	2031	608.48	109.48	49.74
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	267.48	-0.37	2031	554.23	96.27	48.75
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	210.87	-0.35	2031	599.37	105.12	51.72
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	158.14	-0.37	2031	627.96	119.76	44.56
NC recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	81.22	-0.38	2031	645.86	83.05	85.96
lo recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	78.01	-0.42	2031	608.48	109.48	49.74
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	107.59	-0.40	2031	554.23	96.27	48.75
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	93.24	-0.40	2031	599.37	105.12	51.72
hi recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	88.55	-0.40	2031	627.96	119.76	44.56
NC recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	246.01	-0.27	2031	645.86	83.05	85.96
lo recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	152.19	-0.37	2031	608.48	109.48	49.74
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	242.24	-0.37	2031	554.23	96.27	48.75
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	191.17	-0.36	2031	599.37	105.12	51.72

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	69%	40%
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	143.72	-0.37	2031	627.96	119.76	44.56
NC recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	206.76	-0.38	2031	645.86	83.05	85.96
lo recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	139.49	-0.42	2031	608.48	109.48	49.74
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	216.55	-0.41	2031	554.23	96.27	48.75
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	173.76	-0.41	2031	599.37	105.12	51.72
hi recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	135.46	-0.41	2031	627.96	119.76	44.56
NC recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	NC	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.09	-	646.40	83.05	86.10
lo recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.29	2031	608.32	109.48	49.70
mid -d recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.31	2031	544.60	96.27	46.23
mid -f recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.28	2031	598.29	105.12	51.44
hi recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.32	2031	627.19	119.76	44.36
NC recycling, MBT biostab 1	Wet AD with biogas to transport fuel	NC	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.10	-	640.35	83.05	84.51
lo recycling, MBT biostab 1	Wet AD with biogas to transport fuel	lo	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.29	2031	605.31	109.48	48.91
mid -d recycling, MBT biostab 1	Wet AD with biogas to transport fuel	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.31	2031	541.72	96.27	45.48
mid -f recycling, MBT biostab 1	Wet AD with biogas to transport fuel	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.28	2031	595.76	105.12	50.78
hi recycling, MBT biostab 1	Wet AD with biogas to transport fuel	hi	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.32	2031	625.71	119.76	43.97
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	61%	349.91	-0.18	2015	580.90	83.05	68.96
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	279.71	-0.31	2031	577.01	109.48	41.50
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	327.08	-0.34	2031	517.04	96.27	39.02

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
NC recycling, MBT aerobic 2 (landfill)	33%	0%
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%
hi recycling, MBT aerobic 2 (landfill)	75%	0%
NC recycling, MBT biostab 1	32%	0%
lo recycling, MBT biostab 1	67%	0%
mid -d recycling, MBT biostab 1	66%	0%
mid -f recycling, MBT biostab 1	65%	0%
hi recycling, MBT biostab 1	75%	0%
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	41%	61%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	327.53	-0.30	2031	564.30	105.12	42.54
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	266.83	-0.33	2031	599.19	119.76	37.03
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	68%	303.25	-0.19	2015	596.80	83.05	73.12
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	254.11	-0.32	2031	584.97	109.48	43.59
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	275.88	-0.34	2031	527.31	96.27	41.71
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	296.50	-0.30	2031	572.52	105.12	44.70
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	252.38	-0.33	2031	603.91	119.76	38.26
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	93.00	-0.48	2031	596.80	83.05	73.12
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	97.46	-0.46	2031	584.97	109.48	43.59
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	95.46	-0.48	2031	527.31	96.27	41.71
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	109.11	-0.46	2031	572.52	105.12	44.70
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	109.77	-0.44	2031	603.91	119.76	38.26
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	68%	274.63	-0.21	2020	596.80	83.05	73.12
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	230.05	-0.33	2031	584.97	109.48	43.59
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	249.75	-0.35	2031	527.31	96.27	41.71
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	268.33	-0.32	2031	572.52	105.12	44.70
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	228.42	-0.34	2031	603.91	119.76	38.26
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	232.17	-0.45	2031	596.80	83.05	73.12
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	203.82	-0.45	2031	584.97	109.48	43.59

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	51%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	46%	68%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	46%	68%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	216.78	-0.46	2031	527.31	96.27	41.71
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	235.85	-0.45	2031	572.52	105.12	44.70
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	207.08	-0.44	2031	603.91	119.76	38.26
NC recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to transport fuel	NC	Incineration 1 (electricity only)_total	#N/A	30%	0%	62%		413.01	-0.11	-	464.16	83.05	38.41
lo recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to transport fuel	lo	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		346.34	-0.27	2031	523.66	109.48	27.54
mid -d recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		415.19	-0.30	2031	465.69	96.27	25.58
mid -f recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 1 (electricity only)_total	#N/A	30%	0%	52%		412.61	-0.25	2031	507.91	105.12	27.79
hi recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to transport fuel	hi	Incineration 1 (electricity only)_total	#N/A	30%	0%	47%		367.84	-0.28	2031	557.30	119.76	26.07
NC recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	NC	Incineration 2 (low CHP)_total	#N/A	22%	10%	62%		390.93	-0.12	-	586.60	83.05	70.45
lo recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	lo	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		332.78	-0.27	2031	582.87	109.48	43.04
mid -d recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		395.96	-0.31	2031	525.29	96.27	41.18
mid -f recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		395.17	-0.26	2031	569.62	105.12	43.94
hi recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	hi	Incineration 2 (low CHP)_total	#N/A	22%	10%	47%		355.46	-0.28	2031	602.00	119.76	37.77
NC recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	NC	Incineration 3 (medium CHP)_total	#N/A	20%	20%	62%		315.45	-0.18	2015	581.24	83.05	69.05
lo recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		283.15	-0.30	2031	580.27	109.48	42.36
mid -d recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		327.94	-0.33	2031	522.68	96.27	40.50
mid -f recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		332.30	-0.29	2031	566.92	105.12	43.23
hi recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		308.92	-0.31	2031	600.05	119.76	37.25
NC recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		227.57	-0.29	2031	566.44	83.05	65.17

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
NC recycling, Incineration 1 (electricity only)_total	46%	62%
lo recycling, Incineration 1 (electricity only)_total	74%	57%
mid -d recycling, Incineration 1 (electricity only)_total	74%	57%
mid -f recycling, Incineration 1 (electricity only)_total	73%	52%
hi recycling, Incineration 1 (electricity only)_total	80%	47%
NC recycling, Incineration 2 (low CHP)_total	46%	62%
lo recycling, Incineration 2 (low CHP)_total	74%	57%
mid -d recycling, Incineration 2 (low CHP)_total	74%	57%
mid -f recycling, Incineration 2 (low CHP)_total	73%	52%
hi recycling, Incineration 2 (low CHP)_total	80%	47%
NC recycling, Incineration 3 (medium CHP)_total	46%	62%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%
NC recycling, Incineration 4 (high CHP)_total	46%	62%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		218.09	-0.36	2031	573.12	109.48	40.49
mid -d recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		244.09	-0.39	2031	515.48	96.27	38.61
mid -f recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		252.09	-0.35	2031	559.46	105.12	41.28
hi recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		244.81	-0.36	2031	594.64	119.76	35.84
NC recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to transport fuel	NC	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	62%		513.90	-0.07	-	525.21	83.05	54.38
lo recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to transport fuel	lo	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		403.52	-0.24	2031	553.18	109.48	35.27
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		499.56	-0.28	2031	495.40	96.27	33.36
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	52%		487.38	-0.23	2020	538.68	105.12	35.84
hi recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to transport fuel	hi	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	47%		418.51	-0.26	2031	579.59	119.76	31.90
NC recycling, Gasification 1_total	Wet AD with biogas to transport fuel	NC	Gasification 1_total	#N/A	30%	0%	62%		374.54	-0.14	2015	347.84	83.05	7.97
lo recycling, Gasification 1_total	Wet AD with biogas to transport fuel	lo	Gasification 1_total	#N/A	30%	0%	57%		313.64	-0.28	2031	467.41	109.48	12.82
mid -d recycling, Gasification 1_total	Wet AD with biogas to transport fuel	mid -d	Gasification 1_total	#N/A	30%	0%	57%		376.18	-0.32	2031	409.06	96.27	10.76
mid -f recycling, Gasification 1_total	Wet AD with biogas to transport fuel	mid -f	Gasification 1_total	#N/A	30%	0%	52%		373.66	-0.27	2031	449.28	105.12	12.45
hi recycling, Gasification 1_total	Wet AD with biogas to transport fuel	hi	Gasification 1_total	#N/A	30%	0%	47%		332.87	-0.29	2031	514.83	119.76	14.95
NC recycling, Gasification 2_total	Wet AD with biogas to transport fuel	NC	Gasification 2_total	#N/A	21%	0%	62%		521.93	-0.08	-	539.92	83.05	58.23
lo recycling, Gasification 2_total	Wet AD with biogas to transport fuel	lo	Gasification 2_total	#N/A	21%	0%	57%		393.60	-0.25	2031	560.29	109.48	37.13
mid -d recycling, Gasification 2_total	Wet AD with biogas to transport fuel	mid -d	Gasification 2_total	#N/A	21%	0%	57%		496.63	-0.29	2031	502.57	96.27	35.23
mid -f recycling, Gasification 2_total	Wet AD with biogas to transport fuel	mid -f	Gasification 2_total	#N/A	21%	0%	52%		479.12	-0.23569	2020	546.10	105.12	37.78
hi recycling, Gasification 2_total	Wet AD with biogas to transport fuel	hi	Gasification 2_total	#N/A	21%	0%	47%		402.69	-0.26	2031	584.96	119.76	33.31

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, Incineration 4 (high CHP)_total	74%	57%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
NC recycling, Incineration 5 (medium efficiency electricity)_total	46%	62%
lo recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	73%	52%
hi recycling, Incineration 5 (medium efficiency electricity)_total	80%	47%
NC recycling, Gasification 1_total	46%	62%
lo recycling, Gasification 1_total	74%	57%
mid -d recycling, Gasification 1_total	74%	57%
mid -f recycling, Gasification 1_total	73%	52%
hi recycling, Gasification 1_total	80%	47%
NC recycling, Gasification 2_total	46%	62%
lo recycling, Gasification 2_total	74%	57%
mid -d recycling, Gasification 2_total	74%	57%
mid -f recycling, Gasification 2_total	73%	52%
hi recycling, Gasification 2_total	80%	47%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	NC	Gasification Gas Engine 1_total	#N/A	30%	0%	62%		364.20	-0.15	2015	502.41	83.05	48.42
lo recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		307.37	-0.29	2031	542.15	109.48	32.38
mid -d recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	mid -d	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		367.23	-0.32	2031	484.30	96.27	30.45
mid -f recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		365.58	-0.27	2031	527.19	105.12	32.83
hi recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	hi	Gasification Gas Engine 1_total	#N/A	30%	0%	47%		327.17	-0.29	2031	571.26	119.76	29.72
NC recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	NC	Gasification Gas Engine 2_total	#N/A	32%	0%	62%		344.43	-0.16	2015	474.31	83.05	41.06
lo recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		295.09	-0.29	2031	528.56	109.48	28.83
mid -d recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		349.92	-0.33	2031	470.62	96.27	26.88
mid -f recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		349.83	-0.28	2031	513.02	105.12	29.13
hi recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	hi	Gasification Gas Engine 2_total	#N/A	32%	0%	47%		315.92	-0.30	2031	561.00	119.76	27.04
NC recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	NC	True Pyrolysis 1_total	#N/A	32%	0%	62%		346.89	-0.14	2015	529.30	83.05	55.45
lo recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		296.32	-0.28	2031	555.16	109.48	35.79
mid -d recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		351.89	-0.32	2031	497.39	96.27	33.88
mid -f recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		351.51	-0.27	2031	540.74	105.12	36.38
hi recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	hi	True Pyrolysis 1_total	#N/A	32%	0%	47%		316.87	-0.29	2031	581.08	119.76	32.29
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	351.11	-0.26	2031	546.42	83.05	59.93
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	287.31	-0.35	2031	562.03	109.48	37.58
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	Dirty MRF 1	incineration_generic	30%	0%	-	61%	375.82	-0.35	2031	507.85	96.27	36.62
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	353.69	-0.33	2031	549.22	105.12	38.60

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, Gasification Gas Engine 1_total	46%	62%
lo recycling, Gasification Gas Engine 1_total	74%	57%
mid -d recycling, Gasification Gas Engine 1_total	74%	57%
mid -f recycling, Gasification Gas Engine 1_total	73%	52%
hi recycling, Gasification Gas Engine 1_total	80%	47%
NC recycling, Gasification Gas Engine 2_total	46%	62%
lo recycling, Gasification Gas Engine 2_total	74%	57%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
mid -f recycling, Gasification Gas Engine 2_total	73%	52%
hi recycling, Gasification Gas Engine 2_total	80%	47%
NC recycling, True Pyrolysis 1_total	46%	62%
lo recycling, True Pyrolysis 1_total	74%	57%
mid -d recycling, True Pyrolysis 1_total	74%	57%
mid -f recycling, True Pyrolysis 1_total	73%	52%
hi recycling, True Pyrolysis 1_total	80%	47%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	61%
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	58%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	Dirty MRF 1	incineration_generic	30%	0%	-	52%	320.62	-0.34	2031	586.63	119.76	33.74
NC recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	318.41	-0.28	2031	546.42	83.05	59.93
lo recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	260.27	-0.36	2031	562.03	109.48	37.58
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	340.52	-0.36	2031	507.85	96.27	36.62
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	320.34	-0.34	2031	549.22	105.12	38.60
hi recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	290.21	-0.35	2031	586.63	119.76	33.74
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	134.77	-0.38	2031	642.63	83.05	85.11
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	127.71	-0.41	2031	608.92	109.48	49.85
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	122.60	-0.42	2031	550.71	96.27	47.83
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	145.10	-0.40	2031	597.07	105.12	51.12
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	131.85	-0.40	2031	620.72	119.76	42.66
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MHT 1	incineration_generic	30%	0%	-	70%	323.64	-0.21	2020	642.46	83.05	85.07
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MHT 1	incineration_generic	30%	0%	-	64%	241.17	-0.33	2031	608.23	109.48	49.67
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	260.91	-0.35	2031	550.39	96.27	47.75
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	284.50	-0.31	2031	596.48	105.12	50.97
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MHT 1	incineration_generic	30%	0%	-	55%	218.34	-0.34	2031	619.78	119.76	42.42
NC recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MHT 1	cement_kiln	0%	100%	-	70%	92.76	-0.42	2031	642.46	83.05	85.07
lo recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MHT 1	cement_kiln	0%	100%	-	64%	94.98	-0.44	2031	608.23	109.48	49.67
mid -d recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	90.53	-0.44	2031	550.39	96.27	47.75

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	82%	52%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
NC recycling, MHT 2, SRF to Gasification_CHP_generic	52%	70%
lo recycling, MHT 2, SRF to Gasification_CHP_generic	77%	64%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	76%	70%
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	76%	61%
hi recycling, MHT 2, SRF to Gasification_CHP_generic	84%	55%
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	106.76	-0.42	2031	596.48	105.12	50.97
hi recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MHT 1	cement_kiln	0%	100%	-	55%	102.68	-0.41	2031	619.78	119.76	42.42
NC recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MHT 1	ATT_generic	30%	0%	-	70%	293.47	-0.22	2020	642.46	83.05	85.07
lo recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MHT 1	ATT_generic	30%	0%	-	64%	218.53	-0.34	2031	608.23	109.48	49.67
mid -d recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	236.44	-0.36	2031	550.39	96.27	47.75
mid -f recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	257.67	-0.32	2031	596.48	105.12	50.97
hi recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MHT 1	ATT_generic	30%	0%	-	55%	197.88	-0.35	2031	619.78	119.76	42.42
NC recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MHT 1	power_station_generic	36%	0%	-	70%	244.12	-0.40	2031	642.46	83.05	85.07
lo recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MHT 1	power_station_generic	36%	0%	-	64%	194.57	-0.43	2031	608.23	109.48	49.67
mid -d recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	205.31	-0.43	2031	550.39	96.27	47.75
mid -f recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	227.32	-0.41	2031	596.48	105.12	50.97
hi recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MHT 1	power_station_generic	36%	0%	-	55%	181.72	-0.41	2031	619.78	119.76	42.42
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MHT 2	incineration_generic	30%	0%	-	70%	282.76	-0.23	2020	642.46	83.05	85.07
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MHT 2	incineration_generic	30%	0%	-	64%	221.47	-0.34	2031	608.23	109.48	49.67
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	230.06	-0.36	2031	550.39	96.27	47.75
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	259.08	-0.32	2031	596.48	105.12	50.97
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MHT 2	incineration_generic	30%	0%	-	55%	205.89	-0.35	2031	619.78	119.76	42.42
NC recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MHT 2	cement_kiln	0%	100%	-	70%	80.36	-0.46	2031	642.46	83.05	85.07
lo recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MHT 2	cement_kiln	0%	100%	-	64%	84.06	-0.45	2031	608.23	109.48	49.67

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
NC recycling, MHT 1, SRF to Gasification 1	52%	70%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	77.20	-0.46	2031	550.39	96.27	47.75
mid -f recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	93.92	-0.44	2031	596.48	105.12	50.97
hi recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MHT 2	cement_kiln	0%	100%	-	55%	92.91	-0.43	2031	619.78	119.76	42.42
NC recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MHT 2	ATT_generic	30%	0%	-	70%	256.43	-0.24	2020	642.46	83.05	85.07
lo recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MHT 2	ATT_generic	30%	0%	-	64%	200.77	-0.35	2031	608.23	109.48	49.67
mid -d recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	208.58	-0.37	2031	550.39	96.27	47.75
mid -f recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	234.75	-0.33	2031	596.48	105.12	50.97
hi recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MHT 2	ATT_generic	30%	0%	-	55%	186.68	-0.35	2031	619.78	119.76	42.42
NC recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MHT 2	power_station_generic	36%	0%	-	70%	212.88	-0.45	2031	642.46	83.05	85.07
lo recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MHT 2	power_station_generic	36%	0%	-	64%	177.49	-0.45	2031	608.23	109.48	49.67
mid -d recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	179.83	-0.45	2031	550.39	96.27	47.75
mid -f recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	205.68	-0.44	2031	596.48	105.12	50.97
hi recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MHT 2	power_station_generic	36%	0%	-	55%	170.26	-0.43	2031	619.78	119.76	42.42
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MBT aerobic 1	incineration_generic	30%	0%	-	50%	514.74	-0.12	-	588.80	83.05	71.02
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT aerobic 1	incineration_generic	30%	0%	-	43%	358.28	-0.28	2031	579.28	109.48	42.10
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT aerobic 1	incineration_generic	30%	0%	-	40%	491.70	-0.30	2031	519.59	96.27	39.69
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT aerobic 1	incineration_generic	30%	0%	-	38%	440.31	-0.26	2031	567.18	105.12	43.30
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT aerobic 1	incineration_generic	30%	0%	-	33%	351.16	-0.29	2031	602.17	119.76	37.81
NC recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	148.38	-0.29	2031	588.80	83.05	71.02

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
NC recycling, MHT 2, SRF to Gasification 1	52%	70%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	39%	50%
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	71%	43%
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	38%
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	78%	33%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	142.25	-0.37	2031	579.28	109.48	42.10
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	168.82	-0.37	2031	519.59	96.27	39.69
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	162.65	-0.36	2031	567.18	105.12	43.30
hi recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	154.67	-0.37	2031	602.17	119.76	37.81
NC recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MBT aerobic 1	ATT_generic	30%	0%	-	50%	466.61	-0.14	2015	588.80	83.05	71.02
lo recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MBT aerobic 1	ATT_generic	30%	0%	-	43%	324.16	-0.29	2031	579.28	109.48	42.10
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MBT aerobic 1	ATT_generic	30%	0%	-	40%	445.02	-0.31	2031	519.59	96.27	39.69
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	398.36	-0.27	2031	567.18	105.12	43.30
hi recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MBT aerobic 1	ATT_generic	30%	0%	-	33%	317.57	-0.30	2031	602.17	119.76	37.81
NC recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MBT aerobic 1	power_station_generic	36%	0%	-	50%	388.71	-0.31	2031	588.80	83.05	71.02
lo recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	289.12	-0.38	2031	579.28	109.48	42.10
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MBT aerobic 1	power_station_generic	36%	0%	-	40%	385.67	-0.38	2031	519.59	96.27	39.69
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	350.42	-0.37	2031	567.18	105.12	43.30
hi recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MBT aerobic 1	power_station_generic	36%	0%	-	33%	288.55	-0.39	2031	602.17	119.76	37.81
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MBT aerobic 3	incineration_generic	30%	0%	-	50%	451.85	-0.14	2015	588.80	83.05	71.02
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT aerobic 3	incineration_generic	30%	0%	-	43%	330.52	-0.29	2031	579.28	109.48	42.10
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT aerobic 3	incineration_generic	30%	0%	-	40%	448.18	-0.30	2031	519.59	96.27	39.69
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT aerobic 3	incineration_generic	30%	0%	-	38%	403.54	-0.27	2031	567.18	105.12	43.30
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT aerobic 3	incineration_generic	30%	0%	-	33%	331.08	-0.30	2031	602.17	119.76	37.81

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
NC recycling, MBT aerobic 1, SRF to Gasification 1	39%	50%
lo recycling, MBT aerobic 1, SRF to Gasification 1	71%	43%
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	69%	40%
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	69%	38%
hi recycling, MBT aerobic 1, SRF to Gasification 1	78%	33%
NC recycling, MBT aerobic 1, SRF to power_station_generic	38%	50%
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	69%	40%
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	68%	38%
hi recycling, MBT aerobic 1, SRF to power_station_generic	78%	33%
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	39%	50%
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	71%	43%
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	38%
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	78%	33%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	129.10	-0.32	2031	588.80	83.05	71.02
lo recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	126.58	-0.39	2031	579.28	109.48	42.10
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	150.20	-0.39	2031	519.59	96.27	39.69
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	144.57	-0.38	2031	567.18	105.12	43.30
hi recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	140.72	-0.39	2031	602.17	119.76	37.81
NC recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MBT aerobic 3	ATT_generic	30%	0%	-	50%	409.66	-0.15	2015	588.80	83.05	71.02
lo recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MBT aerobic 3	ATT_generic	30%	0%	-	43%	299.18	-0.30	2031	579.28	109.48	42.10
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MBT aerobic 3	ATT_generic	30%	0%	-	40%	405.77	-0.31	2031	519.59	96.27	39.69
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MBT aerobic 3	ATT_generic	30%	0%	-	38%	365.24	-0.28	2031	567.18	105.12	43.30
hi recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MBT aerobic 3	ATT_generic	30%	0%	-	33%	299.52	-0.31	2031	602.17	119.76	37.81
NC recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	340.54	-0.35	2031	588.80	83.05	71.02
lo recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	265.01	-0.41	2031	579.28	109.48	42.10
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MBT aerobic 3	power_station_generic	36%	0%	-	40%	349.84	-0.40	2031	519.59	96.27	39.69
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	319.30	-0.40	2031	567.18	105.12	43.30
hi recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	270.46	-0.41	2031	602.17	119.76	37.81
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	271.32	-0.27	2031	645.69	83.05	85.91
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	167.59	-0.37	2031	607.78	109.48	49.56
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	267.48	-0.37	2031	553.91	96.27	48.67
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	210.87	-0.35	2031	598.79	105.12	51.57

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
NC recycling, MBT aerobic 3, SRF to Gasification 1	39%	50%
lo recycling, MBT aerobic 3, SRF to Gasification 1	71%	43%
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	69%	40%
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	69%	38%
hi recycling, MBT aerobic 3, SRF to Gasification 1	78%	33%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	69%	40%
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	158.14	-0.37	2031	627.02	119.76	44.31
NC recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	81.22	-0.38	2031	645.69	83.05	85.91
lo recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	78.01	-0.42	2031	607.78	109.48	49.56
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	107.59	-0.40	2031	553.91	96.27	48.67
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	93.24	-0.40	2031	598.79	105.12	51.57
hi recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	88.55	-0.40	2031	627.02	119.76	44.31
NC recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	246.01	-0.27	2031	645.69	83.05	85.91
lo recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	152.19	-0.37	2031	607.78	109.48	49.56
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	242.24	-0.37	2031	553.91	96.27	48.67
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	191.17	-0.36	2031	598.79	105.12	51.57
hi recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	143.72	-0.37	2031	627.02	119.76	44.31
NC recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	206.76	-0.38	2031	645.69	83.05	85.91
lo recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	139.49	-0.42	2031	607.78	109.48	49.56
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	216.55	-0.41	2031	553.91	96.27	48.67
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	173.76	-0.41	2031	598.79	105.12	51.57
hi recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	135.46	-0.41	2031	627.02	119.76	44.31
NC recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	NC	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.09	-	646.23	83.05	86.05
lo recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.29	2031	607.62	109.48	49.51
mid -d recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.31	2031	544.28	96.27	46.15

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
NC recycling, MBT aerobic 2 (landfill)	33%	0%
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.28	2031	597.71	105.12	51.29
hi recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.32	2031	626.25	119.76	44.11
NC recycling, MBT biostab 1	Wet AD with biogas to grid injection	NC	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.10	-	640.18	83.05	84.47
lo recycling, MBT biostab 1	Wet AD with biogas to grid injection	lo	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.29	2031	604.61	109.48	48.73
mid -d recycling, MBT biostab 1	Wet AD with biogas to grid injection	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.31	2031	541.40	96.27	45.39
mid -f recycling, MBT biostab 1	Wet AD with biogas to grid injection	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.28	2031	595.18	105.12	50.62
hi recycling, MBT biostab 1	Wet AD with biogas to grid injection	hi	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.32	2031	624.77	119.76	43.72
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	61%	349.91	-0.18	2015	580.73	83.05	68.91
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	279.71	-0.31	2031	576.31	109.48	41.32
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	327.08	-0.34	2031	516.72	96.27	38.94
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	327.53	-0.30	2031	563.72	105.12	42.39
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	266.83	-0.33	2031	598.25	119.76	36.78
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	68%	303.25	-0.19	2015	596.63	83.05	73.07
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	254.11	-0.32	2031	584.27	109.48	43.40
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	275.88	-0.34	2031	526.99	96.27	41.62
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	296.50	-0.30	2031	571.94	105.12	44.54
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	252.38	-0.33	2031	602.97	119.76	38.02
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	93.00	-0.48	2031	596.63	83.05	73.07
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	97.46	-0.46	2031	584.27	109.48	43.40

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%
hi recycling, MBT aerobic 2 (landfill)	75%	0%
NC recycling, MBT biostab 1	32%	0%
lo recycling, MBT biostab 1	67%	0%
mid -d recycling, MBT biostab 1	66%	0%
mid -f recycling, MBT biostab 1	65%	0%
hi recycling, MBT biostab 1	75%	0%
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	41%	61%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	51%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	46%	68%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	95.46	-0.48	2031	526.99	96.27	41.62
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	109.11	-0.46	2031	571.94	105.12	44.54
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	109.77	-0.44	2031	602.97	119.76	38.02
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	68%	274.63	-0.21	2020	596.63	83.05	73.07
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	230.05	-0.33	2031	584.27	109.48	43.40
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	249.75	-0.35	2031	526.99	96.27	41.62
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	268.33	-0.32	2031	571.94	105.12	44.54
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	228.42	-0.34	2031	602.97	119.76	38.02
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	232.17	-0.45	2031	596.63	83.05	73.07
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	203.82	-0.45	2031	584.27	109.48	43.40
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	216.78	-0.46	2031	526.99	96.27	41.62
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	235.85	-0.45	2031	571.94	105.12	44.54
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	207.08	-0.44	2031	602.97	119.76	38.02
NC recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to grid injection	NC	Incineration 1 (electricity only)_total	#N/A	30%	0%	62%		413.01	-0.11	-	464.00	83.05	38.37
lo recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to grid injection	lo	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		346.34	-0.27	2031	522.97	109.48	27.36
mid -d recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to grid injection	mid -d	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		415.19	-0.30	2031	465.37	96.27	25.50
mid -f recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to grid injection	mid -f	Incineration 1 (electricity only)_total	#N/A	30%	0%	52%		412.61	-0.25	2031	507.33	105.12	27.64
hi recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to grid injection	hi	Incineration 1 (electricity only)_total	#N/A	30%	0%	47%		367.84	-0.28	2031	556.36	119.76	25.82
NC recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	NC	Incineration 2 (low CHP)_total	#N/A	22%	10%	62%		390.93	-0.12	-	586.43	83.05	70.40

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	46%	68%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
NC recycling, Incineration 1 (electricity only)_total	46%	62%
lo recycling, Incineration 1 (electricity only)_total	74%	57%
mid -d recycling, Incineration 1 (electricity only)_total	74%	57%
mid -f recycling, Incineration 1 (electricity only)_total	73%	52%
hi recycling, Incineration 1 (electricity only)_total	80%	47%
NC recycling, Incineration 2 (low CHP)_total	46%	62%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	lo	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		332.78	-0.27	2031	582.17	109.48	42.85
mid -d recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	mid -d	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		395.96	-0.31	2031	524.97	96.27	41.10
mid -f recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		395.17	-0.26	2031	569.04	105.12	43.78
hi recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	hi	Incineration 2 (low CHP)_total	#N/A	22%	10%	47%		355.46	-0.28	2031	601.07	119.76	37.52
NC recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	NC	Incineration 3 (medium CHP)_total	#N/A	20%	20%	62%		315.45	-0.18	2015	581.07	83.05	69.00
lo recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		283.15	-0.30	2031	579.58	109.48	42.18
mid -d recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		327.94	-0.33	2031	522.36	96.27	40.41
mid -f recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		332.30	-0.29	2031	566.34	105.12	43.08
hi recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		308.92	-0.31	2031	599.11	119.76	37.01
NC recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		227.57	-0.29	2031	566.27	83.05	65.13
lo recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		218.09	-0.36	2031	572.42	109.48	40.30
mid -d recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		244.09	-0.39	2031	515.16	96.27	38.53
mid -f recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		252.09	-0.35	2031	558.88	105.12	41.13
hi recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		244.81	-0.36	2031	593.71	119.76	35.60
NC recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to grid injection	NC	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	62%		513.90	-0.07	-	525.04	83.05	54.34
lo recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to grid injection	lo	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		403.52	-0.24	2031	552.49	109.48	35.09
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to grid injection	mid -d	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		499.56	-0.28	2031	495.08	96.27	33.28
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to grid injection	mid -f	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	52%		487.38	-0.23	2020	538.10	105.12	35.69
hi recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to grid injection	hi	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	47%		418.51	-0.26	2031	578.65	119.76	31.66

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, Incineration 2 (low CHP)_total	74%	57%
mid -d recycling, Incineration 2 (low CHP)_total	74%	57%
mid -f recycling, Incineration 2 (low CHP)_total	73%	52%
hi recycling, Incineration 2 (low CHP)_total	80%	47%
NC recycling, Incineration 3 (medium CHP)_total	46%	62%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%
NC recycling, Incineration 4 (high CHP)_total	46%	62%
lo recycling, Incineration 4 (high CHP)_total	74%	57%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
NC recycling, Incineration 5 (medium efficiency electricity)_total	46%	62%
lo recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	73%	52%
hi recycling, Incineration 5 (medium efficiency electricity)_total	80%	47%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, Gasification 1_total	Wet AD with biogas to grid injection	NC	Gasification 1_total	#N/A	30%	0%	62%		374.54	-0.14	2015	347.67	83.05	7.93
lo recycling, Gasification 1_total	Wet AD with biogas to grid injection	lo	Gasification 1_total	#N/A	30%	0%	57%		313.64	-0.28	2031	466.71	109.48	12.64
mid -d recycling, Gasification 1_total	Wet AD with biogas to grid injection	mid -d	Gasification 1_total	#N/A	30%	0%	57%		376.18	-0.32	2031	408.74	96.27	10.68
mid -f recycling, Gasification 1_total	Wet AD with biogas to grid injection	mid -f	Gasification 1_total	#N/A	30%	0%	52%		373.66	-0.27	2031	448.70	105.12	12.29
hi recycling, Gasification 1_total	Wet AD with biogas to grid injection	hi	Gasification 1_total	#N/A	30%	0%	47%		332.87	-0.29	2031	513.89	119.76	14.71
NC recycling, Gasification 2_total	Wet AD with biogas to grid injection	NC	Gasification 2_total	#N/A	21%	0%	62%		521.93	-0.08	-	539.75	83.05	58.19
lo recycling, Gasification 2_total	Wet AD with biogas to grid injection	lo	Gasification 2_total	#N/A	21%	0%	57%		393.60	-0.25	2031	559.60	109.48	36.95
mid -d recycling, Gasification 2_total	Wet AD with biogas to grid injection	mid -d	Gasification 2_total	#N/A	21%	0%	57%		496.63	-0.29	2031	502.25	96.27	35.15
mid -f recycling, Gasification 2_total	Wet AD with biogas to grid injection	mid -f	Gasification 2_total	#N/A	21%	0%	52%		479.12	-0.23568	2020	545.51	105.12	37.63
hi recycling, Gasification 2_total	Wet AD with biogas to grid injection	hi	Gasification 2_total	#N/A	21%	0%	47%		402.69	-0.26	2031	584.02	119.76	33.06
NC recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	NC	Gasification Gas Engine 1_total	#N/A	30%	0%	62%		364.20	-0.15	2015	502.24	83.05	48.37
lo recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		307.37	-0.29	2031	541.46	109.48	32.20
mid -d recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	mid -d	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		367.23	-0.32	2031	483.98	96.27	30.37
mid -f recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		365.58	-0.27	2031	526.60	105.12	32.68
hi recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	hi	Gasification Gas Engine 1_total	#N/A	30%	0%	47%		327.17	-0.29	2031	570.33	119.76	29.48
NC recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	NC	Gasification Gas Engine 2_total	#N/A	32%	0%	62%		344.43	-0.16	2015	474.14	83.05	41.02
lo recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		295.09	-0.29	2031	527.87	109.48	28.65
mid -d recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		349.92	-0.33	2031	470.30	96.27	26.79
mid -f recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		349.83	-0.28	2031	512.44	105.12	28.97

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, Gasification 1_total	46%	62%
lo recycling, Gasification 1_total	74%	57%
mid -d recycling, Gasification 1_total	74%	57%
mid -f recycling, Gasification 1_total	73%	52%
hi recycling, Gasification 1_total	80%	47%
NC recycling, Gasification 2_total	46%	62%
lo recycling, Gasification 2_total	74%	57%
mid -d recycling, Gasification 2_total	74%	57%
mid -f recycling, Gasification 2_total	73%	52%
hi recycling, Gasification 2_total	80%	47%
NC recycling, Gasification Gas Engine 1_total	46%	62%
lo recycling, Gasification Gas Engine 1_total	74%	57%
mid -d recycling, Gasification Gas Engine 1_total	74%	57%
mid -f recycling, Gasification Gas Engine 1_total	73%	52%
hi recycling, Gasification Gas Engine 1_total	80%	47%
NC recycling, Gasification Gas Engine 2_total	46%	62%
lo recycling, Gasification Gas Engine 2_total	74%	57%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
mid -f recycling, Gasification Gas Engine 2_total	73%	52%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	hi	Gasification Gas Engine 2_total	#N/A	32%	0%	47%		315.92	-0.30	2031	560.07	119.76	26.79
NC recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	NC	True Pyrolysis 1_total	#N/A	32%	0%	62%		346.89	-0.14	2015	529.13	83.05	55.41
lo recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		296.32	-0.28	2031	554.46	109.48	35.60
mid -d recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		351.89	-0.32	2031	497.07	96.27	33.80
mid -f recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		351.51	-0.27	2031	540.16	105.12	36.23
hi recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	hi	True Pyrolysis 1_total	#N/A	32%	0%	47%		316.87	-0.29	2031	580.14	119.76	32.05
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	351.11	-0.26	2031	546.25	83.05	59.89
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	287.31	-0.35	2031	561.33	109.48	37.40
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	Dirty MRF 1	incineration_generic	30%	0%	-	61%	375.82	-0.35	2031	507.53	96.27	36.53
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	353.69	-0.33	2031	548.64	105.12	38.45
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	Dirty MRF 1	incineration_generic	30%	0%	-	52%	320.62	-0.34	2031	585.69	119.76	33.50
NC recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	318.41	-0.28	2031	546.25	83.05	59.89
lo recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	260.27	-0.36	2031	561.33	109.48	37.40
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	340.52	-0.36	2031	507.53	96.27	36.53
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	320.34	-0.34	2031	548.64	105.12	38.45
hi recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	290.21	-0.35	2031	585.69	119.76	33.50
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	134.77	-0.38	2031	642.46	83.05	85.07
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	127.71	-0.41	2031	608.23	109.48	49.67
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	122.60	-0.42	2031	550.39	96.27	47.75

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, Gasification Gas Engine 2_total	80%	47%
NC recycling, True Pyrolysis 1_total	46%	62%
lo recycling, True Pyrolysis 1_total	74%	57%
mid -d recycling, True Pyrolysis 1_total	74%	57%
mid -f recycling, True Pyrolysis 1_total	73%	52%
hi recycling, True Pyrolysis 1_total	80%	47%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	61%
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	58%
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	82%	52%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
NC recycling, MHT 2, SRF to Gasification_CHP_generic	52%	70%
lo recycling, MHT 2, SRF to Gasification_CHP_generic	77%	64%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	76%	70%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	145.10	-0.40	2031	596.48	105.12	50.97
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	131.85	-0.40	2031	619.78	119.76	42.42
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MHT 1	incineration_generic	30%	0%	-	70%	354.62	-0.21	2020	642.19	83.05	85.00
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MHT 1	incineration_generic	30%	0%	-	64%	432.94	-0.33	2031	607.11	109.48	49.38
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	380.30	-0.35	2031	549.87	96.27	47.61
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	471.66	-0.31	2031	595.55	105.12	50.72
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MHT 1	incineration_generic	30%	0%	-	55%	545.38	-0.34	2031	618.27	119.76	42.02
NC recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	NC	MHT 1	cement_kiln	0%	100%	-	70%	95.27	-0.42	2031	642.19	83.05	85.00
lo recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	lo	MHT 1	cement_kiln	0%	100%	-	64%	116.61	-0.44	2031	607.11	109.48	49.38
mid -d recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	102.32	-0.44	2031	549.87	96.27	47.61
mid -f recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	126.95	-0.42	2031	595.55	105.12	50.72
hi recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	hi	MHT 1	cement_kiln	0%	100%	-	55%	147.11	-0.41	2031	618.27	119.76	42.02
NC recycling, MHT 1, SRF to Gasification 1	Aerobic Digestion	NC	MHT 1	ATT_generic	30%	0%	-	70%	321.84	-0.22	2020	642.19	83.05	85.00
lo recycling, MHT 1, SRF to Gasification 1	Aerobic Digestion	lo	MHT 1	ATT_generic	30%	0%	-	64%	393.91	-0.34	2031	607.11	109.48	49.38
mid -d recycling, MHT 1, SRF to Gasification 1	Aerobic Digestion	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	345.66	-0.36	2031	549.87	96.27	47.61
mid -f recycling, MHT 1, SRF to Gasification 1	Aerobic Digestion	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	428.83	-0.32	2031	595.55	105.12	50.72
hi recycling, MHT 1, SRF to Gasification 1	Aerobic Digestion	hi	MHT 1	ATT_generic	30%	0%	-	55%	496.94	-0.35	2031	618.27	119.76	42.02
NC recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	NC	MHT 1	power_station_generic	36%	0%	-	70%	263.44	-0.40	2031	642.19	83.05	85.00
lo recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	lo	MHT 1	power_station_generic	36%	0%	-	64%	322.46	-0.43	2031	607.11	109.48	49.38

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	76%	61%
hi recycling, MHT 2, SRF to Gasification_CHP_generic	84%	55%
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
NC recycling, MHT 1, SRF to Gasification 1	52%	70%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	282.95	-0.43	2031	549.87	96.27	47.61
mid -f recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	351.04	-0.41	2031	595.55	105.12	50.72
hi recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	hi	MHT 1	power_station_generic	36%	0%	-	55%	406.84	-0.41	2031	618.27	119.76	42.02
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MHT 2	incineration_generic	30%	0%	-	70%	306.05	-0.23	2020	642.19	83.05	85.00
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MHT 2	incineration_generic	30%	0%	-	64%	372.66	-0.34	2031	607.11	109.48	49.38
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	317.68	-0.36	2031	549.87	96.27	47.61
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	405.12	-0.32	2031	595.55	105.12	50.72
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MHT 2	incineration_generic	30%	0%	-	55%	472.63	-0.35	2031	618.27	119.76	42.02
NC recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	NC	MHT 2	cement_kiln	0%	100%	-	70%	82.22	-0.46	2031	642.19	83.05	85.00
lo recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	lo	MHT 2	cement_kiln	0%	100%	-	64%	100.37	-0.45	2031	607.11	109.48	49.38
mid -d recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	85.48	-0.46	2031	549.87	96.27	47.61
mid -f recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	109.04	-0.44	2031	595.55	105.12	50.72
hi recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	hi	MHT 2	cement_kiln	0%	100%	-	55%	127.48	-0.43	2031	618.27	119.76	42.02
NC recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	NC	MHT 2	ATT_generic	30%	0%	-	70%	277.76	-0.24	2020	642.19	83.05	85.00
lo recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	lo	MHT 2	ATT_generic	30%	0%	-	64%	339.07	-0.35	2031	607.11	109.48	49.38
mid -d recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	288.74	-0.37	2031	549.87	96.27	47.61
mid -f recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	368.33	-0.33	2031	595.55	105.12	50.72
hi recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	hi	MHT 2	ATT_generic	30%	0%	-	55%	430.65	-0.35	2031	618.27	119.76	42.02
NC recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	NC	MHT 2	power_station_generic	36%	0%	-	70%	227.35	-0.45	2031	642.19	83.05	85.00

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
NC recycling, MHT 2, SRF to Gasification 1	52%	70%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	lo	MHT 2	power_station_generic	36%	0%	-	64%	277.57	-0.45	2031	607.11	109.48	49.38
mid -d recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	236.36	-0.45	2031	549.87	96.27	47.61
mid -f recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	301.52	-0.44	2031	595.55	105.12	50.72
hi recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	hi	MHT 2	power_station_generic	36%	0%	-	55%	352.57	-0.43	2031	618.27	119.76	42.02
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MBT aerobic 1	incineration_generic	30%	0%	-	50%	569.31	-0.12	-	588.53	83.05	70.95
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MBT aerobic 1	incineration_generic	30%	0%	-	43%	656.74	-0.28	2031	578.16	109.48	41.80
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MBT aerobic 1	incineration_generic	30%	0%	-	40%	708.92	-0.30	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MBT aerobic 1	incineration_generic	30%	0%	-	38%	714.82	-0.26	2031	566.24	105.12	43.05
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MBT aerobic 1	incineration_generic	30%	0%	-	33%	779.07	-0.29	2031	600.66	119.76	37.42
NC recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	152.93	-0.29	2031	588.53	83.05	70.95
lo recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	176.72	-0.37	2031	578.16	109.48	41.80
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	190.57	-0.37	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	192.23	-0.36	2031	566.24	105.12	43.05
hi recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	209.74	-0.37	2031	600.66	119.76	37.42
NC recycling, MBT aerobic 1, SRF to Gasification 1	Aerobic Digestion	NC	MBT aerobic 1	ATT_generic	30%	0%	-	50%	516.62	-0.14	2015	588.53	83.05	70.95
lo recycling, MBT aerobic 1, SRF to Gasification 1	Aerobic Digestion	lo	MBT aerobic 1	ATT_generic	30%	0%	-	43%	596.98	-0.29	2031	578.16	109.48	41.80
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	Aerobic Digestion	mid -d	MBT aerobic 1	ATT_generic	30%	0%	-	40%	643.75	-0.31	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Aerobic Digestion	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	649.37	-0.27	2031	566.24	105.12	43.05
hi recycling, MBT aerobic 1, SRF to Gasification 1	Aerobic Digestion	hi	MBT aerobic 1	ATT_generic	30%	0%	-	33%	708.51	-0.30	2031	600.66	119.76	37.42

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	39%	50%
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	71%	43%
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	38%
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	78%	33%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
NC recycling, MBT aerobic 1, SRF to Gasification 1	39%	50%
lo recycling, MBT aerobic 1, SRF to Gasification 1	71%	43%
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	69%	40%
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	69%	38%
hi recycling, MBT aerobic 1, SRF to Gasification 1	78%	33%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT aerobic 1, SRF to power_station_generic	Aerobic Digestion	NC	MBT aerobic 1	power_station_generic	36%	0%	-	50%	422.87	-0.31	2031	588.53	83.05	70.95
lo recycling, MBT aerobic 1, SRF to power_station_generic	Aerobic Digestion	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	488.69	-0.38	2031	578.16	109.48	41.80
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	Aerobic Digestion	mid -d	MBT aerobic 1	power_station_generic	36%	0%	-	40%	526.95	-0.38	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	Aerobic Digestion	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	531.55	-0.37	2031	566.24	105.12	43.05
hi recycling, MBT aerobic 1, SRF to power_station_generic	Aerobic Digestion	hi	MBT aerobic 1	power_station_generic	36%	0%	-	33%	579.99	-0.39	2031	600.66	119.76	37.42
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MBT aerobic 3	incineration_generic	30%	0%	-	50%	493.29	-0.14	2015	588.53	83.05	70.95
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MBT aerobic 3	incineration_generic	30%	0%	-	43%	568.47	-0.29	2031	578.16	109.48	41.80
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MBT aerobic 3	incineration_generic	30%	0%	-	40%	621.53	-0.30	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MBT aerobic 3	incineration_generic	30%	0%	-	38%	622.22	-0.27	2031	566.24	105.12	43.05
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MBT aerobic 3	incineration_generic	30%	0%	-	33%	685.78	-0.30	2031	600.66	119.76	37.42
NC recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	132.51	-0.32	2031	588.53	83.05	70.95
lo recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	152.97	-0.39	2031	578.16	109.48	41.80
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	167.08	-0.39	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	167.33	-0.38	2031	566.24	105.12	43.05
hi recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	184.62	-0.39	2031	600.66	119.76	37.42
NC recycling, MBT aerobic 3, SRF to Gasification 1	Aerobic Digestion	NC	MBT aerobic 3	ATT_generic	30%	0%	-	50%	447.63	-0.15	2015	588.53	83.05	70.95
lo recycling, MBT aerobic 3, SRF to Gasification 1	Aerobic Digestion	lo	MBT aerobic 3	ATT_generic	30%	0%	-	43%	516.74	-0.30	2031	578.16	109.48	41.80
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	Aerobic Digestion	mid -d	MBT aerobic 3	ATT_generic	30%	0%	-	40%	564.39	-0.31	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	Aerobic Digestion	mid -f	MBT aerobic 3	ATT_generic	30%	0%	-	38%	565.24	-0.28	2031	566.24	105.12	43.05

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT aerobic 1, SRF to power_station_generic	38%	50%
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	69%	40%
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	68%	38%
hi recycling, MBT aerobic 1, SRF to power_station_generic	78%	33%
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	39%	50%
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	71%	43%
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	38%
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	78%	33%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
NC recycling, MBT aerobic 3, SRF to Gasification 1	39%	50%
lo recycling, MBT aerobic 3, SRF to Gasification 1	71%	43%
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	69%	40%
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	69%	38%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT aerobic 3, SRF to Gasification 1	Aerobic Digestion	hi	MBT aerobic 3	ATT_generic	30%	0%	-	33%	623.67	-0.31	2031	600.66	119.76	37.42
NC recycling, MBT aerobic 3, SRF to power_station_generic	Aerobic Digestion	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	366.40	-0.35	2031	588.53	83.05	70.95
lo recycling, MBT aerobic 3, SRF to power_station_generic	Aerobic Digestion	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	423.00	-0.41	2031	578.16	109.48	41.80
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	Aerobic Digestion	mid -d	MBT aerobic 3	power_station_generic	36%	0%	-	40%	461.99	-0.40	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Aerobic Digestion	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	462.69	-0.40	2031	566.24	105.12	43.05
hi recycling, MBT aerobic 3, SRF to power_station_generic	Aerobic Digestion	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	510.54	-0.41	2031	600.66	119.76	37.42
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	316.27	-0.27	2031	645.42	83.05	85.84
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	406.05	-0.37	2031	606.67	109.48	49.26
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	499.29	-0.37	2031	553.39	96.27	48.53
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	465.72	-0.35	2031	597.85	105.12	51.32
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	579.23	-0.37	2031	625.51	119.76	43.92
NC recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	85.01	-0.38	2031	645.42	83.05	85.84
lo recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	109.66	-0.42	2031	606.67	109.48	49.26
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	134.46	-0.40	2031	553.39	96.27	48.53
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	125.59	-0.40	2031	597.85	105.12	51.32
hi recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	156.71	-0.40	2031	625.51	119.76	43.92
NC recycling, MBT aerobic 4, SRF to Gasification 1	Aerobic Digestion	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	287.15	-0.27	2031	645.42	83.05	85.84
lo recycling, MBT aerobic 4, SRF to Gasification 1	Aerobic Digestion	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	370.45	-0.37	2031	606.67	109.48	49.26
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Aerobic Digestion	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	454.20	-0.37	2031	553.39	96.27	48.53

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT aerobic 3, SRF to Gasification 1	78%	33%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	69%	40%
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Aerobic Digestion	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	424.25	-0.36	2031	597.85	105.12	51.32
hi recycling, MBT aerobic 4, SRF to Gasification 1	Aerobic Digestion	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	529.39	-0.37	2031	625.51	119.76	43.92
NC recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	235.05	-0.38	2031	645.42	83.05	85.84
lo recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	303.30	-0.42	2031	606.67	109.48	49.26
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	371.82	-0.41	2031	553.39	96.27	48.53
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	347.32	-0.41	2031	597.85	105.12	51.32
hi recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	433.46	-0.41	2031	625.51	119.76	43.92
NC recycling, MBT aerobic 2 (landfill)	Aerobic Digestion	NC	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	0.00	-0.09	-	645.96	83.05	85.98
lo recycling, MBT aerobic 2 (landfill)	Aerobic Digestion	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	0.00	-0.29	2031	606.51	109.48	49.22
mid -d recycling, MBT aerobic 2 (landfill)	Aerobic Digestion	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	0.00	-0.31	2031	543.76	96.27	46.01
mid -f recycling, MBT aerobic 2 (landfill)	Aerobic Digestion	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	0.00	-0.28	2031	596.77	105.12	51.04
hi recycling, MBT aerobic 2 (landfill)	Aerobic Digestion	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	0.00	-0.32	2031	624.74	119.76	43.72
NC recycling, MBT biostab 1	Aerobic Digestion	NC	MBT biostab 1	#N/A	0%	0%	-	0%	0.00	-0.10	-	639.91	83.05	84.40
lo recycling, MBT biostab 1	Aerobic Digestion	lo	MBT biostab 1	#N/A	0%	0%	-	0%	0.00	-0.29	2031	603.49	109.48	48.43
mid -d recycling, MBT biostab 1	Aerobic Digestion	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	0.00	-0.31	2031	540.88	96.27	45.26
mid -f recycling, MBT biostab 1	Aerobic Digestion	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	0.00	-0.28	2031	594.24	105.12	50.38
hi recycling, MBT biostab 1	Aerobic Digestion	hi	MBT biostab 1	#N/A	0%	0%	-	0%	0.00	-0.32	2031	623.26	119.76	43.33
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	61%	375.27	-0.18	2015	580.46	83.05	68.84
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	445.47	-0.31	2031	575.20	109.48	41.03

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
NC recycling, MBT aerobic 2 (landfill)	33%	0%
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%
hi recycling, MBT aerobic 2 (landfill)	75%	0%
NC recycling, MBT biostab 1	32%	0%
lo recycling, MBT biostab 1	67%	0%
mid -d recycling, MBT biostab 1	66%	0%
mid -f recycling, MBT biostab 1	65%	0%
hi recycling, MBT biostab 1	75%	0%
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	41%	61%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	436.04	-0.34	2031	516.20	96.27	38.80
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	480.19	-0.30	2031	562.78	105.12	42.15
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	523.49	-0.33	2031	596.74	119.76	36.39
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	68%	322.06	-0.19	2015	596.36	83.05	73.00
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	383.39	-0.32	2031	583.15	109.48	43.11
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	349.19	-0.34	2031	526.48	96.27	41.49
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	415.95	-0.30	2031	571.00	105.12	44.30
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	470.01	-0.33	2031	601.46	119.76	37.62
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	94.80	-0.48	2031	596.36	83.05	73.00
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	113.01	-0.46	2031	583.15	109.48	43.11
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	103.44	-0.48	2031	526.48	96.27	41.49
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	123.01	-0.46	2031	571.00	105.12	44.30
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	140.02	-0.44	2031	601.46	119.76	37.62
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	NC	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	68%	291.80	-0.21	2020	596.36	83.05	73.00
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	348.01	-0.33	2031	583.15	109.48	43.11
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	316.65	-0.35	2031	526.48	96.27	41.49
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	377.32	-0.32	2031	571.00	105.12	44.30
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	426.91	-0.34	2031	601.46	119.76	37.62
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	244.32	-0.45	2031	596.36	83.05	73.00

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	51%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	46%	68%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	46%	68%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	291.38	-0.45	2031	583.15	109.48	43.11
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	265.48	-0.46	2031	526.48	96.27	41.49
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	316.21	-0.45	2031	571.00	105.12	44.30
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	358.29	-0.44	2031	601.46	119.76	37.62
NC recycling, Incineration 1 (electricity only)_total	Aerobic Digestion	NC	Incineration 1 (electricity only)_total	#N/A	30%	0%	62%		435.76	-0.11	-	463.72	83.05	38.30
lo recycling, Incineration 1 (electricity only)_total	Aerobic Digestion	lo	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		503.64	-0.27	2031	521.85	109.48	27.07
mid -d recycling, Incineration 1 (electricity only)_total	Aerobic Digestion	mid -d	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		508.12	-0.30	2031	464.85	96.27	25.36
mid -f recycling, Incineration 1 (electricity only)_total	Aerobic Digestion	mid -f	Incineration 1 (electricity only)_total	#N/A	30%	0%	52%		555.21	-0.25	2031	506.39	105.12	27.39
hi recycling, Incineration 1 (electricity only)_total	Aerobic Digestion	hi	Incineration 1 (electricity only)_total	#N/A	30%	0%	47%		625.02	-0.28	2031	554.85	119.76	25.43
NC recycling, Incineration 2 (low CHP)_total	Aerobic Digestion	NC	Incineration 2 (low CHP)_total	#N/A	22%	10%	62%		411.24	-0.12	-	586.16	83.05	70.33
lo recycling, Incineration 2 (low CHP)_total	Aerobic Digestion	lo	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		475.30	-0.27	2031	581.05	109.48	42.56
mid -d recycling, Incineration 2 (low CHP)_total	Aerobic Digestion	mid -d	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		479.53	-0.31	2031	524.45	96.27	40.96
mid -f recycling, Incineration 2 (low CHP)_total	Aerobic Digestion	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		523.96	-0.26	2031	568.10	105.12	43.54
hi recycling, Incineration 2 (low CHP)_total	Aerobic Digestion	hi	Incineration 2 (low CHP)_total	#N/A	22%	10%	47%		589.85	-0.28	2031	599.56	119.76	37.13
NC recycling, Incineration 3 (medium CHP)_total	Aerobic Digestion	NC	Incineration 3 (medium CHP)_total	#N/A	20%	20%	62%		328.48	-0.18	2015	580.80	83.05	68.93
lo recycling, Incineration 3 (medium CHP)_total	Aerobic Digestion	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		379.65	-0.30	2031	578.46	109.48	41.88
mid -d recycling, Incineration 3 (medium CHP)_total	Aerobic Digestion	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		383.03	-0.33	2031	521.84	96.27	40.28
mid -f recycling, Incineration 3 (medium CHP)_total	Aerobic Digestion	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		418.53	-0.29	2031	565.40	105.12	42.83
hi recycling, Incineration 3 (medium CHP)_total	Aerobic Digestion	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		471.15	-0.31	2031	597.60	119.76	36.61

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
NC recycling, Incineration 1 (electricity only)_total	46%	62%
lo recycling, Incineration 1 (electricity only)_total	74%	57%
mid -d recycling, Incineration 1 (electricity only)_total	74%	57%
mid -f recycling, Incineration 1 (electricity only)_total	73%	52%
hi recycling, Incineration 1 (electricity only)_total	80%	47%
NC recycling, Incineration 2 (low CHP)_total	46%	62%
lo recycling, Incineration 2 (low CHP)_total	74%	57%
mid -d recycling, Incineration 2 (low CHP)_total	74%	57%
mid -f recycling, Incineration 2 (low CHP)_total	73%	52%
hi recycling, Incineration 2 (low CHP)_total	80%	47%
NC recycling, Incineration 3 (medium CHP)_total	46%	62%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		234.22	-0.29	2031	566.00	83.05	65.06
lo recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		270.70	-0.36	2031	571.31	109.48	40.01
mid -d recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		273.11	-0.39	2031	514.64	96.27	38.39
mid -f recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		298.42	-0.35	2031	557.94	105.12	40.88
hi recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		335.95	-0.36	2031	592.20	119.76	35.20
NC recycling, Incineration 5 (medium efficiency electricity)_total	Aerobic Digestion	NC	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	62%		549.73	-0.07	-	524.77	83.05	54.27
lo recycling, Incineration 5 (medium efficiency electricity)_total	Aerobic Digestion	lo	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		635.37	-0.24	2031	551.37	109.48	34.79
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	Aerobic Digestion	mid -d	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		641.02	-0.28	2031	494.57	96.27	33.14
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	Aerobic Digestion	mid -f	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	52%		700.42	-0.23	2020	537.16	105.12	35.44
hi recycling, Incineration 5 (medium efficiency electricity)_total	Aerobic Digestion	hi	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	47%		788.49	-0.26	2031	577.14	119.76	31.26
NC recycling, Gasification 1_total	Aerobic Digestion	NC	Gasification 1_total	#N/A	30%	0%	62%		395.39	-0.14	2015	347.40	83.05	7.86
lo recycling, Gasification 1_total	Aerobic Digestion	lo	Gasification 1_total	#N/A	30%	0%	57%		457.54	-0.28	2031	465.59	109.48	12.35
mid -d recycling, Gasification 1_total	Aerobic Digestion	mid -d	Gasification 1_total	#N/A	30%	0%	57%		461.28	-0.32	2031	408.22	96.27	10.55
mid -f recycling, Gasification 1_total	Aerobic Digestion	mid -f	Gasification 1_total	#N/A	30%	0%	52%		504.17	-0.27	2031	447.76	105.12	12.05
hi recycling, Gasification 1_total	Aerobic Digestion	hi	Gasification 1_total	#N/A	30%	0%	47%		568.01	-0.29	2031	512.38	119.76	14.31
NC recycling, Gasification 2_total	Aerobic Digestion	NC	Gasification 2_total	#N/A	21%	0%	62%		563.56	-0.08	-	539.48	83.05	58.12
lo recycling, Gasification 2_total	Aerobic Digestion	lo	Gasification 2_total	#N/A	21%	0%	57%		652.15	-0.25	2031	558.48	109.48	36.66
mid -d recycling, Gasification 2_total	Aerobic Digestion	mid -d	Gasification 2_total	#N/A	21%	0%	57%		657.47	-0.29	2031	501.73	96.27	35.01
mid -f recycling, Gasification 2_total	Aerobic Digestion	mid -f	Gasification 2_total	#N/A	21%	0%	52%		718.60	-0.23566	2020	544.58	105.12	37.38

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, Incineration 4 (high CHP)_total	46%	62%
lo recycling, Incineration 4 (high CHP)_total	74%	57%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
NC recycling, Incineration 5 (medium efficiency electricity)_total	46%	62%
lo recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	73%	52%
hi recycling, Incineration 5 (medium efficiency electricity)_total	80%	47%
NC recycling, Gasification 1_total	46%	62%
lo recycling, Gasification 1_total	74%	57%
mid -d recycling, Gasification 1_total	74%	57%
mid -f recycling, Gasification 1_total	73%	52%
hi recycling, Gasification 1_total	80%	47%
NC recycling, Gasification 2_total	46%	62%
lo recycling, Gasification 2_total	74%	57%
mid -d recycling, Gasification 2_total	74%	57%
mid -f recycling, Gasification 2_total	73%	52%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, Gasification 2_total	Aerobic Digestion	hi	Gasification 2_total	#N/A	21%	0%	47%		809.59	-0.26	2031	582.51	119.76	32.67
NC recycling, Gasification Gas Engine 1_total	Aerobic Digestion	NC	Gasification Gas Engine 1_total	#N/A	30%	0%	62%		383.88	-0.15	2015	501.97	83.05	48.30
lo recycling, Gasification Gas Engine 1_total	Aerobic Digestion	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		444.22	-0.29	2031	540.34	109.48	31.91
mid -d recycling, Gasification Gas Engine 1_total	Aerobic Digestion	mid -d	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		447.85	-0.32	2031	483.46	96.27	30.24
mid -f recycling, Gasification Gas Engine 1_total	Aerobic Digestion	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		489.49	-0.27	2031	525.67	105.12	32.43
hi recycling, Gasification Gas Engine 1_total	Aerobic Digestion	hi	Gasification Gas Engine 1_total	#N/A	30%	0%	47%		551.47	-0.29	2031	568.81	119.76	29.08
NC recycling, Gasification Gas Engine 2_total	Aerobic Digestion	NC	Gasification Gas Engine 2_total	#N/A	32%	0%	62%		361.96	-0.16	2015	473.87	83.05	40.95
lo recycling, Gasification Gas Engine 2_total	Aerobic Digestion	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		418.86	-0.29	2031	526.75	109.48	28.35
mid -d recycling, Gasification Gas Engine 2_total	Aerobic Digestion	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		422.28	-0.33	2031	469.79	96.27	26.66
mid -f recycling, Gasification Gas Engine 2_total	Aerobic Digestion	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		461.54	-0.28	2031	511.50	105.12	28.73
hi recycling, Gasification Gas Engine 2_total	Aerobic Digestion	hi	Gasification Gas Engine 2_total	#N/A	32%	0%	47%		519.98	-0.30	2031	558.55	119.76	26.40
NC recycling, True Pyrolysis 1_total	Aerobic Digestion	NC	True Pyrolysis 1_total	#N/A	32%	0%	62%		364.76	-0.14	2015	528.86	83.05	55.34
lo recycling, True Pyrolysis 1_total	Aerobic Digestion	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		422.12	-0.28	2031	553.34	109.48	35.31
mid -d recycling, True Pyrolysis 1_total	Aerobic Digestion	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		425.55	-0.32	2031	496.56	96.27	33.66
mid -f recycling, True Pyrolysis 1_total	Aerobic Digestion	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		465.12	-0.27	2031	539.22	105.12	35.98
hi recycling, True Pyrolysis 1_total	Aerobic Digestion	hi	True Pyrolysis 1_total	#N/A	32%	0%	47%		524.04	-0.29	2031	578.63	119.76	31.65
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	372.55	-0.26	2031	545.98	83.05	59.82
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	434.74	-0.35	2031	560.21	109.48	37.11
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	Dirty MRF 1	incineration_generic	30%	0%	-	61%	466.94	-0.35	2031	507.02	96.27	36.40

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, Gasification 2_total	80%	47%
NC recycling, Gasification Gas Engine 1_total	46%	62%
lo recycling, Gasification Gas Engine 1_total	74%	57%
mid -d recycling, Gasification Gas Engine 1_total	74%	57%
mid -f recycling, Gasification Gas Engine 1_total	73%	52%
hi recycling, Gasification Gas Engine 1_total	80%	47%
NC recycling, Gasification Gas Engine 2_total	46%	62%
lo recycling, Gasification Gas Engine 2_total	74%	57%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
mid -f recycling, Gasification Gas Engine 2_total	73%	52%
hi recycling, Gasification Gas Engine 2_total	80%	47%
NC recycling, True Pyrolysis 1_total	46%	62%
lo recycling, True Pyrolysis 1_total	74%	57%
mid -d recycling, True Pyrolysis 1_total	74%	57%
mid -f recycling, True Pyrolysis 1_total	73%	52%
hi recycling, True Pyrolysis 1_total	80%	47%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	61%

APPENDIX C – SCENARIO OUTPUTS – ALL SCENARIOS

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	492.11	-0.33	2031	547.70	105.12	38.20
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	Dirty MRF 1	incineration_generic	30%	0%	-	52%	573.17	-0.34	2031	584.18	119.76	33.10
NC recycling, Dirty MRF 1, SRF to Gasification 1	Aerobic Digestion	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	338.05	-0.28	2031	545.98	83.05	59.82
lo recycling, Dirty MRF 1, SRF to Gasification 1	Aerobic Digestion	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	395.13	-0.36	2031	560.21	109.48	37.11
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Aerobic Digestion	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	423.94	-0.36	2031	507.02	96.27	36.40
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Aerobic Digestion	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	446.99	-0.34	2031	547.70	105.12	38.20
hi recycling, Dirty MRF 1, SRF to Gasification 1	Aerobic Digestion	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	521.11	-0.35	2031	584.18	119.76	33.10
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	140.29	-0.38	2031	642.19	83.05	85.00
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	171.25	-0.41	2031	607.11	109.48	49.38
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	145.84	-0.42	2031	549.87	96.27	47.61
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	186.04	-0.40	2031	595.55	105.12	50.72
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	217.51	-0.40	2031	618.27	119.76	42.02

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	58%
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	82%	52%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
NC recycling, MHT 2, SRF to Gasification_CHP_generic	52%	70%
lo recycling, MHT 2, SRF to Gasification_CHP_generic	77%	64%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	76%	70%
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	76%	61%
hi recycling, MHT 2, SRF to Gasification_CHP_generic	84%	55%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT aerobic 2 (landfill)	Aerobic Digestion	NC	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	0.00	-0.09	-	645.96	83.05	85.98
lo recycling, MBT aerobic 2 (landfill)	Aerobic Digestion	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	0.00	-0.29	2031	606.51	109.48	49.22
mid -d recycling, MBT aerobic 2 (landfill)	Aerobic Digestion	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	0.00	-0.31	2031	543.76	96.27	46.01
mid -f recycling, MBT aerobic 2 (landfill)	Aerobic Digestion	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	0.00	-0.28	2031	596.77	105.12	51.04
hi recycling, MBT aerobic 2 (landfill)	Aerobic Digestion	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	0.00	-0.32	2031	624.74	119.76	43.72
NC recycling, MBT biostab 1	Aerobic Digestion	NC	MBT biostab 1	#N/A	0%	0%	-	0%	0.00	-0.10	-	639.91	83.05	84.40
lo recycling, MBT biostab 1	Aerobic Digestion	lo	MBT biostab 1	#N/A	0%	0%	-	0%	0.00	-0.29	2031	603.49	109.48	48.43
mid -d recycling, MBT biostab 1	Aerobic Digestion	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	0.00	-0.31	2031	540.88	96.27	45.26
mid -f recycling, MBT biostab 1	Aerobic Digestion	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	0.00	-0.28	2031	594.24	105.12	50.38
hi recycling, MBT biostab 1	Aerobic Digestion	hi	MBT biostab 1	#N/A	0%	0%	-	0%	0.00	-0.32	2031	623.26	119.76	43.33
NC recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	NC	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.09	-	646.40	83.05	86.10
lo recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.29	2031	608.32	109.48	49.70
mid -f recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.28	2031	598.29	105.12	51.44
hi recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.32	2031	627.19	119.76	44.36
NC recycling, MBT biostab 1	Wet AD with biogas to transport fuel	NC	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.10	-	640.35	83.05	84.51
lo recycling, MBT biostab 1	Wet AD with biogas to transport fuel	lo	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.29	2031	605.31	109.48	48.91
mid -f recycling, MBT biostab 1	Wet AD with biogas to transport fuel	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.28	2031	595.76	105.12	50.78
hi recycling, MBT biostab 1	Wet AD with biogas to transport fuel	hi	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.32	2031	625.71	119.76	43.97
NC recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	NC	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.09	-	646.23	83.05	86.05
lo recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.29	2031	607.62	109.48	49.51

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT aerobic 2 (landfill)	33%	0%
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%
hi recycling, MBT aerobic 2 (landfill)	75%	0%
NC recycling, MBT biostab 1	32%	0%
lo recycling, MBT biostab 1	67%	0%
mid -d recycling, MBT biostab 1	66%	0%
mid -f recycling, MBT biostab 1	65%	0%
hi recycling, MBT biostab 1	75%	0%
NC recycling, MBT aerobic 2 (landfill)	33%	0%
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%
hi recycling, MBT aerobic 2 (landfill)	75%	0%
NC recycling, MBT biostab 1	32%	0%
lo recycling, MBT biostab 1	67%	0%
mid -f recycling, MBT biostab 1	65%	0%
hi recycling, MBT biostab 1	75%	0%
NC recycling, MBT aerobic 2 (landfill)	33%	0%
lo recycling, MBT aerobic 2 (landfill)	68%	0%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.28	2031	597.71	105.12	51.29
hi recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.32	2031	626.25	119.76	44.11
NC recycling, MBT biostab 1	Wet AD with biogas to grid injection	NC	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.10	-	640.18	83.05	84.47
lo recycling, MBT biostab 1	Wet AD with biogas to grid injection	lo	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.29	2031	604.61	109.48	48.73
mid -f recycling, MBT biostab 1	Wet AD with biogas to grid injection	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.28	2031	595.18	105.12	50.62
hi recycling, MBT biostab 1	Wet AD with biogas to grid injection	hi	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.32	2031	624.77	119.76	43.72
mid -d recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.31	2031	544.60	96.27	46.23
mid -d recycling, MBT biostab 1	Wet AD with biogas to transport fuel	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.31	2031	541.72	96.27	45.48
mid -d recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.31	2031	544.28	96.27	46.15
mid -d recycling, MBT biostab 1	Wet AD with biogas to grid injection	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.31	2031	541.40	96.27	45.39
hi recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.35	2031	618.64	119.76	42.12
hi recycling, MBT biostab 1	Wet AD with electricity generation	hi	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.35	2031	617.16	119.76	41.73
NC recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	NC	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.10	-	644.86	83.05	85.69
lo recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.31	2031	601.99	109.48	48.04
mid -f recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.30	2031	592.98	105.12	50.05
NC recycling, MBT biostab 1	Wet AD with electricity generation	NC	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.11	-	638.82	83.05	84.11
lo recycling, MBT biostab 1	Wet AD with electricity generation	lo	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.31	2031	598.98	109.48	47.25
mid -f recycling, MBT biostab 1	Wet AD with electricity generation	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.30	2031	590.46	105.12	49.39
mid -d recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.32	2031	541.67	96.27	45.47
mid -d recycling, MBT biostab 1	Wet AD with electricity generation	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.32	2031	538.79	96.27	44.71

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%
hi recycling, MBT aerobic 2 (landfill)	75%	0%
NC recycling, MBT biostab 1	32%	0%
lo recycling, MBT biostab 1	67%	0%
mid -f recycling, MBT biostab 1	65%	0%
hi recycling, MBT biostab 1	75%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -d recycling, MBT biostab 1	66%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -d recycling, MBT biostab 1	66%	0%
hi recycling, MBT aerobic 2 (landfill)	75%	0%
hi recycling, MBT biostab 1	75%	0%
NC recycling, MBT aerobic 2 (landfill)	33%	0%
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%
NC recycling, MBT biostab 1	32%	0%
lo recycling, MBT biostab 1	67%	0%
mid -f recycling, MBT biostab 1	65%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -d recycling, MBT biostab 1	66%	0%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	77.20	-0.46	2031	550.71	96.27	47.83
mid -d recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	77.20	-0.46	2031	550.39	96.27	47.75
lo recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	78.01	-0.42	2031	608.48	109.48	49.74
lo recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	78.01	-0.42	2031	607.78	109.48	49.56
NC recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MHT 2	cement_kiln	0%	100%	-	70%	80.36	-0.46	2031	642.63	83.05	85.11
NC recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MHT 2	cement_kiln	0%	100%	-	70%	80.36	-0.46	2031	642.46	83.05	85.07
NC recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	81.22	-0.38	2031	645.86	83.05	85.96
NC recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	81.22	-0.38	2031	645.69	83.05	85.91
NC recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	NC	MHT 2	cement_kiln	0%	100%	-	70%	81.57	-0.46	2031	641.10	83.05	84.71
NC recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	NC	MHT 2	cement_kiln	0%	100%	-	70%	82.17	-0.46	2031	642.20	83.05	85.00
NC recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	NC	MHT 2	cement_kiln	0%	100%	-	70%	82.22	-0.46	2031	642.19	83.05	85.00
mid -d recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	82.40	-0.47	2031	547.78	96.27	47.06
NC recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	83.65	-0.38	2031	644.33	83.05	85.55
lo recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MHT 2	cement_kiln	0%	100%	-	64%	84.06	-0.45	2031	608.92	109.48	49.85
lo recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MHT 2	cement_kiln	0%	100%	-	64%	84.06	-0.45	2031	608.23	109.48	49.67
NC recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	84.84	-0.38	2031	645.43	83.05	85.84
NC recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	85.01	-0.38	2031	645.42	83.05	85.84
mid -d recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	85.09	-0.46	2031	549.88	96.27	47.62
mid -d recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	85.48	-0.46	2031	549.87	96.27	47.61
hi recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	88.55	-0.40	2031	627.96	119.76	44.56

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	88.55	-0.40	2031	627.02	119.76	44.31
mid -d recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	90.53	-0.44	2031	550.71	96.27	47.83
mid -d recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	90.53	-0.44	2031	550.39	96.27	47.75
NC recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MHT 1	cement_kiln	0%	100%	-	70%	92.76	-0.42	2031	642.63	83.05	85.11
NC recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MHT 1	cement_kiln	0%	100%	-	70%	92.76	-0.42	2031	642.46	83.05	85.07
hi recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MHT 2	cement_kiln	0%	100%	-	55%	92.91	-0.43	2031	620.72	119.76	42.66
hi recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MHT 2	cement_kiln	0%	100%	-	55%	92.91	-0.43	2031	619.78	119.76	42.42
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	93.00	-0.48	2031	596.80	83.05	73.12
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	93.00	-0.48	2031	596.63	83.05	73.07
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	93.24	-0.40	2031	599.37	105.12	51.72
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	93.24	-0.40	2031	598.79	105.12	51.57
lo recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	lo	MHT 2	cement_kiln	0%	100%	-	64%	93.88	-0.48	2031	602.59	109.48	48.20
mid -f recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	93.92	-0.44	2031	597.07	105.12	51.12
mid -f recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	93.92	-0.44	2031	596.48	105.12	50.97
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	94.15	-0.48	2031	595.27	83.05	72.72
NC recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	NC	MHT 1	cement_kiln	0%	100%	-	70%	94.37	-0.43	2031	641.10	83.05	84.71
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	94.65	-0.48	2031	596.37	83.05	73.00
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	94.80	-0.48	2031	596.36	83.05	73.00
lo recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MHT 1	cement_kiln	0%	100%	-	64%	94.98	-0.44	2031	608.92	109.48	49.85
lo recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MHT 1	cement_kiln	0%	100%	-	64%	94.98	-0.44	2031	608.23	109.48	49.67

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	NC	MHT 1	cement_kiln	0%	100%	-	70%	95.06	-0.42	2031	642.20	83.05	85.00
NC recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	NC	MHT 1	cement_kiln	0%	100%	-	70%	95.27	-0.42	2031	642.19	83.05	85.00
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	95.46	-0.48	2031	527.31	96.27	41.71
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	95.46	-0.48	2031	526.99	96.27	41.62
lo recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	95.67	-0.44	2031	602.15	109.48	48.08
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	97.46	-0.46	2031	584.97	109.48	43.59
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	97.46	-0.46	2031	584.27	109.48	43.40
mid -d recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	97.77	-0.45	2031	547.78	96.27	47.06
lo recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	lo	MHT 2	cement_kiln	0%	100%	-	64%	98.55	-0.45	2031	607.14	109.48	49.39
lo recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	lo	MHT 2	cement_kiln	0%	100%	-	64%	100.37	-0.45	2031	607.11	109.48	49.38
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	100.44	-0.49	2031	524.39	96.27	40.94
mid -d recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	100.97	-0.44	2031	549.88	96.27	47.62
mid -d recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	102.32	-0.44	2031	549.87	96.27	47.61
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	102.52	-0.48	2031	526.49	96.27	41.49
hi recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MHT 1	cement_kiln	0%	100%	-	55%	102.68	-0.41	2031	620.72	119.76	42.66
hi recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MHT 1	cement_kiln	0%	100%	-	55%	102.68	-0.41	2031	619.78	119.76	42.42
mid -f recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	103.06	-0.46	2031	591.76	105.12	49.73
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	103.44	-0.48	2031	526.48	96.27	41.49
lo recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	104.72	-0.42	2031	606.69	109.48	49.27
mid -f recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	106.76	-0.42	2031	597.07	105.12	51.12

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	106.76	-0.42	2031	596.48	105.12	50.97
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	106.84	-0.48	2031	578.64	109.48	41.93
mid -f recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	106.95	-0.44	2031	595.57	105.12	50.73
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	107.59	-0.40	2031	554.23	96.27	48.75
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	107.59	-0.40	2031	553.91	96.27	48.67
lo recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	lo	MHT 1	cement_kiln	0%	100%	-	64%	107.71	-0.46	2031	602.59	109.48	48.20
mid -f recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	109.04	-0.44	2031	595.55	105.12	50.72
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	109.11	-0.46	2031	572.52	105.12	44.70
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	109.11	-0.46	2031	571.94	105.12	44.54
lo recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	109.66	-0.42	2031	606.67	109.48	49.26
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	109.77	-0.44	2031	603.91	119.76	38.26
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	109.77	-0.44	2031	602.97	119.76	38.02
lo recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.29	2031	606.53	109.48	49.23
mid -f recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.28	2031	596.79	105.12	51.05
lo recycling, MBT biostab 1	Dry AD with electricity generation	lo	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.29	2031	603.52	109.48	48.44
mid -f recycling, MBT biostab 1	Dry AD with electricity generation	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.28	2031	594.27	105.12	50.39
NC recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	NC	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.09	-	645.97	83.05	85.98
hi recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.32	2031	624.78	119.76	43.73
NC recycling, MBT biostab 1	Dry AD with electricity generation	NC	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.10	-	639.92	83.05	84.40
hi recycling, MBT biostab 1	Dry AD with electricity generation	hi	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.32	2031	623.30	119.76	43.34

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%
lo recycling, MBT biostab 1	67%	0%
mid -f recycling, MBT biostab 1	65%	0%
NC recycling, MBT aerobic 2 (landfill)	33%	0%
hi recycling, MBT aerobic 2 (landfill)	75%	0%
NC recycling, MBT biostab 1	32%	0%
hi recycling, MBT biostab 1	75%	0%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.31	2031	543.77	96.27	46.02
mid -d recycling, MBT biostab 1	Dry AD with electricity generation	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.31	2031	540.89	96.27	45.26
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	110.69	-0.46	2031	583.18	109.48	43.12
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	111.45	-0.42	2031	594.06	105.12	50.33
hi recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	hi	MHT 2	cement_kiln	0%	100%	-	55%	112.19	-0.46	2031	612.17	119.76	40.43
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	113.01	-0.46	2031	583.15	109.48	43.11
lo recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	lo	MHT 1	cement_kiln	0%	100%	-	64%	113.06	-0.44	2031	607.14	109.48	49.39
lo recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	lo	MHT 1	cement_kiln	0%	100%	-	64%	116.61	-0.44	2031	607.11	109.48	49.38
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	117.54	-0.47	2031	567.22	105.12	43.31
mid -f recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	118.73	-0.44	2031	591.76	105.12	49.73
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	119.26	-0.40	2031	597.87	105.12	51.33
hi recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	hi	MHT 2	cement_kiln	0%	100%	-	55%	120.49	-0.43	2031	618.31	119.76	42.03
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	120.63	-0.46	2031	571.03	105.12	44.30
hi recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	121.76	-0.43	2031	619.41	119.76	42.32
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	122.60	-0.42	2031	550.71	96.27	47.83
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	122.60	-0.42	2031	550.39	96.27	47.75
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	123.01	-0.46	2031	571.00	105.12	44.30
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	123.14	-0.41	2031	551.30	96.27	47.99
mid -f recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	123.21	-0.42	2031	595.57	105.12	50.73
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	125.59	-0.40	2031	597.85	105.12	51.32

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -d recycling, MBT biostab 1	66%	0%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	76%	70%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	76%	70%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	126.58	-0.39	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	126.58	-0.39	2031	579.28	109.48	42.10
hi recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	hi	MHT 1	cement_kiln	0%	100%	-	55%	126.76	-0.44	2031	612.17	119.76	40.43
mid -f recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	126.95	-0.42	2031	595.55	105.12	50.72
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	127.09	-0.47	2031	595.36	119.76	36.03
hi recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	hi	MHT 2	cement_kiln	0%	100%	-	55%	127.48	-0.43	2031	618.27	119.76	42.02
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	127.71	-0.41	2031	608.92	109.48	49.85
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	127.71	-0.41	2031	608.23	109.48	49.67
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	128.91	-0.40	2031	553.40	96.27	48.54
NC recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	129.10	-0.32	2031	588.97	83.05	71.07
NC recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	129.10	-0.32	2031	588.80	83.05	71.02
NC recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	131.24	-0.33	2031	587.44	83.05	70.67
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	131.85	-0.40	2031	620.72	119.76	42.66
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	131.85	-0.40	2031	619.78	119.76	42.42
NC recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	131.90	-0.32	2031	588.54	83.05	70.96
NC recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	132.51	-0.32	2031	588.53	83.05	70.95
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	133.39	-0.44	2031	601.50	119.76	37.63
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	134.46	-0.40	2031	553.39	96.27	48.53
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	134.77	-0.38	2031	642.63	83.05	85.11
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	134.77	-0.38	2031	642.46	83.05	85.07

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
lo recycling, MHT 2, SRF to Gasification_CHP_generic	77%	64%
lo recycling, MHT 2, SRF to Gasification_CHP_generic	77%	64%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
hi recycling, MHT 2, SRF to Gasification_CHP_generic	84%	55%
hi recycling, MHT 2, SRF to Gasification_CHP_generic	84%	55%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
NC recycling, MHT 2, SRF to Gasification_CHP_generic	52%	70%
NC recycling, MHT 2, SRF to Gasification_CHP_generic	52%	70%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	135.46	-0.41	2031	627.96	119.76	44.56
hi recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	135.46	-0.41	2031	627.02	119.76	44.31
hi recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	hi	MHT 1	cement_kiln	0%	100%	-	55%	136.14	-0.41	2031	618.31	119.76	42.03
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	136.26	-0.43	2031	547.78	96.27	47.06
hi recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	136.76	-0.40	2031	625.55	119.76	43.93
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	138.20	-0.38	2031	641.10	83.05	84.71
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	139.21	-0.38	2031	642.20	83.05	85.00
lo recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	139.49	-0.42	2031	608.48	109.48	49.74
lo recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	139.49	-0.42	2031	607.78	109.48	49.56
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	140.02	-0.44	2031	601.46	119.76	37.62
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	140.29	-0.38	2031	642.19	83.05	85.00
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	140.72	-0.42	2031	549.88	96.27	47.62
hi recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	140.72	-0.39	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	140.72	-0.39	2031	602.17	119.76	37.81
lo recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	141.96	-0.41	2031	573.64	109.48	40.62
lo recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	142.25	-0.37	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	142.25	-0.37	2031	579.28	109.48	42.10
hi recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	143.72	-0.37	2031	627.96	119.76	44.56
hi recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	143.72	-0.37	2031	627.02	119.76	44.31
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	144.57	-0.38	2031	567.76	105.12	43.45

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic		
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
NC recycling, MHT 2, SRF to Gasification_CHP_generic		
NC recycling, MHT 2, SRF to Gasification_CHP_generic	52%	70%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
NC recycling, MHT 2, SRF to Gasification_CHP_generic	52%	70%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	76%	70%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	144.57	-0.38	2031	567.18	105.12	43.30
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	145.10	-0.40	2031	597.07	105.12	51.12
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	145.10	-0.40	2031	596.48	105.12	50.97
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	145.84	-0.42	2031	549.87	96.27	47.61
lo recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	146.81	-0.39	2031	578.19	109.48	41.81
hi recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	hi	MHT 1	cement_kiln	0%	100%	-	55%	147.11	-0.41	2031	618.27	119.76	42.02
NC recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	148.38	-0.29	2031	588.97	83.05	71.07
NC recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	148.38	-0.29	2031	588.80	83.05	71.02
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	150.20	-0.39	2031	519.91	96.27	39.77
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	150.20	-0.39	2031	519.59	96.27	39.69
NC recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	151.21	-0.29	2031	587.44	83.05	70.67
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	151.83	-0.44	2031	602.59	109.48	48.20
NC recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	151.97	-0.29	2031	588.54	83.05	70.96
lo recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	152.19	-0.37	2031	608.48	109.48	49.74
lo recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	152.19	-0.37	2031	607.78	109.48	49.56
NC recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	152.93	-0.29	2031	588.53	83.05	70.95
lo recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	152.97	-0.39	2031	578.16	109.48	41.80
hi recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	154.67	-0.37	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	154.67	-0.37	2031	602.17	119.76	37.81
hi recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	156.71	-0.40	2031	625.51	119.76	43.92

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	76%	61%
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	76%	61%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	76%	70%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
lo recycling, MHT 2, SRF to Gasification_CHP_generic		
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	158.01	-0.39	2031	562.45	105.12	42.06
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	158.14	-0.37	2031	627.96	119.76	44.56
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	158.14	-0.37	2031	627.02	119.76	44.31
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	159.38	-0.41	2031	607.14	109.48	49.39
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	160.33	-0.40	2031	516.98	96.27	39.00
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	161.73	-0.38	2031	566.26	105.12	43.06
lo recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	161.96	-0.39	2031	573.64	109.48	40.62
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	162.65	-0.36	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	162.65	-0.36	2031	567.18	105.12	43.30
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	163.02	-0.39	2031	519.08	96.27	39.55
hi recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	165.19	-0.42	2031	594.56	119.76	35.82
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	167.08	-0.39	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	167.33	-0.38	2031	566.24	105.12	43.05
lo recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	167.50	-0.37	2031	578.19	109.48	41.81
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	167.59	-0.37	2031	608.48	109.48	49.74
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	167.59	-0.37	2031	607.78	109.48	49.56
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	168.14	-0.42	2031	591.76	105.12	49.73
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	168.82	-0.37	2031	519.91	96.27	39.77
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	168.82	-0.37	2031	519.59	96.27	39.69
hi recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MHT 2	power_station_generic	36%	0%	-	55%	170.26	-0.43	2031	620.72	119.76	42.66

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
lo recycling, MHT 2, SRF to Gasification_CHP_generic	77%	64%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic		
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MHT 2	power_station_generic	36%	0%	-	55%	170.26	-0.43	2031	619.78	119.76	42.42
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	171.25	-0.41	2031	607.11	109.48	49.38
hi recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	172.14	-0.39	2031	600.70	119.76	37.43
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	173.76	-0.41	2031	599.37	105.12	51.72
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	173.76	-0.41	2031	598.79	105.12	51.57
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	174.38	-0.43	2031	612.17	119.76	40.43
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	174.49	-0.40	2031	595.57	105.12	50.73
lo recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	176.72	-0.37	2031	578.16	109.48	41.80
lo recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MHT 2	power_station_generic	36%	0%	-	64%	177.49	-0.45	2031	608.92	109.48	49.85
lo recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MHT 2	power_station_generic	36%	0%	-	64%	177.49	-0.45	2031	608.23	109.48	49.67
mid -d recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	179.83	-0.45	2031	550.71	96.27	47.83
mid -d recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	179.83	-0.45	2031	550.39	96.27	47.75
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	179.87	-0.38	2031	562.45	105.12	42.06
hi recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MHT 1	power_station_generic	36%	0%	-	55%	181.72	-0.41	2031	620.72	119.76	42.66
hi recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MHT 1	power_station_generic	36%	0%	-	55%	181.72	-0.41	2031	619.78	119.76	42.42
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	181.72	-0.38	2031	516.98	96.27	39.00
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	184.10	-0.36	2031	566.26	105.12	43.06
hi recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	184.62	-0.39	2031	600.66	119.76	37.42
hi recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	184.75	-0.40	2031	594.56	119.76	35.82
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	184.78	-0.37	2031	519.08	96.27	39.55

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
lo recycling, MHT 2, SRF to Gasification_CHP_generic	77%	64%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
hi recycling, MHT 2, SRF to Gasification_CHP_generic		
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	76%	61%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	186.04	-0.40	2031	595.55	105.12	50.72
hi recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MHT 2	ATT_generic	30%	0%	-	55%	186.68	-0.35	2031	620.72	119.76	42.66
hi recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MHT 2	ATT_generic	30%	0%	-	55%	186.68	-0.35	2031	619.78	119.76	42.42
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	187.28	-0.40	2031	618.31	119.76	42.03
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	190.57	-0.37	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	191.17	-0.36	2031	599.37	105.12	51.72
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	191.17	-0.36	2031	598.79	105.12	51.57
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	192.23	-0.36	2031	566.24	105.12	43.05
hi recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	192.52	-0.37	2031	600.70	119.76	37.43
lo recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MHT 1	power_station_generic	36%	0%	-	64%	194.57	-0.43	2031	608.92	109.48	49.85
lo recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MHT 1	power_station_generic	36%	0%	-	64%	194.57	-0.43	2031	608.23	109.48	49.67
hi recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MHT 1	ATT_generic	30%	0%	-	55%	197.88	-0.35	2031	620.72	119.76	42.66
hi recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MHT 1	ATT_generic	30%	0%	-	55%	197.88	-0.35	2031	619.78	119.76	42.42
lo recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MHT 2	ATT_generic	30%	0%	-	64%	200.77	-0.35	2031	608.92	109.48	49.85
lo recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MHT 2	ATT_generic	30%	0%	-	64%	200.77	-0.35	2031	608.23	109.48	49.67
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	203.82	-0.45	2031	584.97	109.48	43.59
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	203.82	-0.45	2031	584.27	109.48	43.40
mid -d recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	205.31	-0.43	2031	550.71	96.27	47.83
mid -d recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	205.31	-0.43	2031	550.39	96.27	47.75
mid -f recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	205.68	-0.44	2031	597.07	105.12	51.12

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	76%	61%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
hi recycling, MHT 2, SRF to Gasification_CHP_generic	84%	55%
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	205.68	-0.44	2031	596.48	105.12	50.97
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MHT 2	incineration_generic	30%	0%	-	55%	205.89	-0.35	2031	620.72	119.76	42.66
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MHT 2	incineration_generic	30%	0%	-	55%	205.89	-0.35	2031	619.78	119.76	42.42
NC recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	206.76	-0.38	2031	645.86	83.05	85.96
NC recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	206.76	-0.38	2031	645.69	83.05	85.91
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	207.08	-0.44	2031	603.91	119.76	38.26
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	207.08	-0.44	2031	602.97	119.76	38.02
mid -d recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	208.58	-0.37	2031	550.71	96.27	47.83
mid -d recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	208.58	-0.37	2031	550.39	96.27	47.75
lo recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	208.65	-0.44	2031	602.15	109.48	48.08
hi recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	209.74	-0.37	2031	600.66	119.76	37.42
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	210.87	-0.35	2031	599.37	105.12	51.72
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	210.87	-0.35	2031	598.79	105.12	51.57
mid -d recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	211.01	-0.46	2031	547.78	96.27	47.06
NC recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MHT 2	power_station_generic	36%	0%	-	70%	212.88	-0.45	2031	642.63	83.05	85.11
NC recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MHT 2	power_station_generic	36%	0%	-	70%	212.88	-0.45	2031	642.46	83.05	85.07
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	216.55	-0.41	2031	554.23	96.27	48.75
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	216.55	-0.41	2031	553.91	96.27	48.67
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	216.78	-0.46	2031	527.31	96.27	41.71
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	216.78	-0.46	2031	526.99	96.27	41.62

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	217.51	-0.40	2031	618.27	119.76	42.02
mid -d recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	217.94	-0.45	2031	549.88	96.27	47.62
lo recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		218.09	-0.36	2031	573.12	109.48	40.49
lo recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		218.09	-0.36	2031	572.42	109.48	40.30
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MHT 1	incineration_generic	30%	0%	-	55%	218.34	-0.34	2031	620.72	119.76	42.66
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MHT 1	incineration_generic	30%	0%	-	55%	218.34	-0.34	2031	619.78	119.76	42.42
lo recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MHT 1	ATT_generic	30%	0%	-	64%	218.53	-0.34	2031	608.92	109.48	49.85
lo recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MHT 1	ATT_generic	30%	0%	-	64%	218.53	-0.34	2031	608.23	109.48	49.67
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MHT 2	incineration_generic	30%	0%	-	64%	221.47	-0.34	2031	608.92	109.48	49.85
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MHT 2	incineration_generic	30%	0%	-	64%	221.47	-0.34	2031	608.23	109.48	49.67
NC recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	NC	MHT 2	power_station_generic	36%	0%	-	70%	221.61	-0.46	2031	641.10	83.05	84.71
NC recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	NC	MHT 2	power_station_generic	36%	0%	-	70%	223.24	-0.45	2031	642.20	83.05	85.00
NC recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	223.37	-0.39	2031	644.33	83.05	85.55
NC recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	226.58	-0.38	2031	645.43	83.05	85.84
mid -f recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	227.32	-0.41	2031	597.07	105.12	51.12
mid -f recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	227.32	-0.41	2031	596.48	105.12	50.97
NC recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	NC	MHT 2	power_station_generic	36%	0%	-	70%	227.35	-0.45	2031	642.19	83.05	85.00
NC recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		227.57	-0.29	2031	566.44	83.05	65.17
NC recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		227.57	-0.29	2031	566.27	83.05	65.13
lo recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	lo	MHT 2	power_station_generic	36%	0%	-	64%	228.07	-0.47	2031	602.59	109.48	48.20

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MHT 2, SRF to Gasification_CHP_generic	84%	55%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
lo recycling, Incineration 4 (high CHP)_total	74%	57%
lo recycling, Incineration 4 (high CHP)_total	74%	57%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
NC recycling, Incineration 4 (high CHP)_total	46%	62%
NC recycling, Incineration 4 (high CHP)_total	46%	62%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	228.42	-0.34	2031	603.91	119.76	38.26
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	228.42	-0.34	2031	602.97	119.76	38.02
lo recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	228.47	-0.42	2031	606.69	109.48	49.27
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	230.05	-0.33	2031	584.97	109.48	43.59
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	230.05	-0.33	2031	584.27	109.48	43.40
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	230.06	-0.36	2031	550.71	96.27	47.83
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	230.06	-0.36	2031	550.39	96.27	47.75
NC recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		231.63	-0.30	2031	564.91	83.05	64.77
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	232.17	-0.45	2031	596.80	83.05	73.12
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	232.17	-0.45	2031	596.63	83.05	73.07
NC recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		232.35	-0.29	2031	566.01	83.05	65.06
hi recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	233.17	-0.44	2031	619.41	119.76	42.32
NC recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		234.22	-0.29	2031	566.00	83.05	65.06
mid -f recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	234.75	-0.33	2031	597.07	105.12	51.12
mid -f recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	234.75	-0.33	2031	596.48	105.12	50.97
NC recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	235.05	-0.38	2031	645.42	83.05	85.84
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	235.85	-0.45	2031	572.52	105.12	44.70
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	235.85	-0.45	2031	571.94	105.12	44.54
mid -d recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	236.36	-0.45	2031	549.87	96.27	47.61
mid -d recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	236.44	-0.36	2031	550.71	96.27	47.83

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
NC recycling, Incineration 4 (high CHP)_total	46%	62%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
NC recycling, Incineration 4 (high CHP)_total	46%	62%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
NC recycling, Incineration 4 (high CHP)_total	46%	62%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	236.44	-0.36	2031	550.39	96.27	47.75
lo recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	237.83	-0.39	2031	602.15	109.48	48.08
lo recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	lo	MHT 2	power_station_generic	36%	0%	-	64%	239.46	-0.45	2031	607.14	109.48	49.39
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	239.52	-0.46	2031	595.27	83.05	72.72
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	240.79	-0.45	2031	596.37	83.05	73.00
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MHT 1	incineration_generic	30%	0%	-	64%	241.17	-0.33	2031	608.92	109.48	49.85
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MHT 1	incineration_generic	30%	0%	-	64%	241.17	-0.33	2031	608.23	109.48	49.67
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	242.24	-0.37	2031	554.23	96.27	48.75
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	242.24	-0.37	2031	553.91	96.27	48.67
mid -d recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		244.09	-0.39	2031	515.48	96.27	38.61
mid -d recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		244.09	-0.39	2031	515.16	96.27	38.53
NC recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MHT 1	power_station_generic	36%	0%	-	70%	244.12	-0.40	2031	642.63	83.05	85.11
NC recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MHT 1	power_station_generic	36%	0%	-	70%	244.12	-0.40	2031	642.46	83.05	85.07
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	244.32	-0.45	2031	596.36	83.05	73.00
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	244.39	-0.47	2031	524.39	96.27	40.94
hi recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		244.81	-0.36	2031	594.64	119.76	35.84
hi recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		244.81	-0.36	2031	593.71	119.76	35.60
NC recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	246.01	-0.27	2031	645.86	83.05	85.96
NC recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	246.01	-0.27	2031	645.69	83.05	85.91
mid -d recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	246.97	-0.44	2031	547.78	96.27	47.06

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		247.72	-0.38	2031	566.79	109.48	38.83
hi recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	hi	MHT 2	power_station_generic	36%	0%	-	55%	249.04	-0.46	2031	612.17	119.76	40.43
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	249.48	-0.46	2031	526.49	96.27	41.49
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	249.75	-0.35	2031	527.31	96.27	41.71
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	249.75	-0.35	2031	526.99	96.27	41.62
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	249.97	-0.47	2031	578.64	109.48	41.93
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	250.30	-0.43	2031	594.06	105.12	50.33
mid -d recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	251.48	-0.38	2031	547.78	96.27	47.06
mid -f recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		252.09	-0.35	2031	559.46	105.12	41.28
mid -f recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		252.09	-0.35	2031	558.88	105.12	41.13
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	252.38	-0.33	2031	603.91	119.76	38.26
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	252.38	-0.33	2031	602.97	119.76	38.02
lo recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		253.15	-0.36	2031	571.33	109.48	40.02
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	254.11	-0.32	2031	584.97	109.48	43.59
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	254.11	-0.32	2031	584.27	109.48	43.40
mid -d recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	255.09	-0.43	2031	549.88	96.27	47.62
mid -f recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	255.54	-0.46	2031	591.76	105.12	49.73
NC recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	NC	MHT 1	power_station_generic	36%	0%	-	70%	255.67	-0.41	2031	641.10	83.05	84.71
NC recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MHT 2	ATT_generic	30%	0%	-	70%	256.43	-0.24	2020	642.63	83.05	85.11
NC recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MHT 2	ATT_generic	30%	0%	-	70%	256.43	-0.24	2020	642.46	83.05	85.07

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, Incineration 4 (high CHP)_total	74%	57%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
lo recycling, Incineration 4 (high CHP)_total	74%	57%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
NC recycling, MHT 2, SRF to Gasification 1	52%	70%
NC recycling, MHT 2, SRF to Gasification 1	52%	70%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	lo	MHT 1	power_station_generic	36%	0%	-	64%	257.06	-0.45	2031	602.59	109.48	48.20
NC recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	NC	MHT 1	power_station_generic	36%	0%	-	70%	257.56	-0.40	2031	642.20	83.05	85.00
mid -f recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	257.67	-0.32	2031	597.07	105.12	51.12
mid -f recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	257.67	-0.32	2031	596.48	105.12	50.97
hi recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	257.92	-0.40	2031	619.41	119.76	42.32
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	259.02	-0.45	2031	583.18	109.48	43.12
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	259.08	-0.32	2031	597.07	105.12	51.12
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	259.08	-0.32	2031	596.48	105.12	50.97
mid -d recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	259.70	-0.37	2031	549.88	96.27	47.62
lo recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	260.27	-0.36	2031	562.03	109.48	37.58
lo recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	260.27	-0.36	2031	561.33	109.48	37.40
lo recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	260.33	-0.37	2031	606.69	109.48	49.27
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	260.91	-0.35	2031	550.71	96.27	47.83
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	260.91	-0.35	2031	550.39	96.27	47.75
mid -d recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		261.17	-0.40	2031	512.55	96.27	37.85
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	261.19	-0.39	2031	602.15	109.48	48.08
hi recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	262.01	-0.41	2031	625.55	119.76	43.93
NC recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	NC	MHT 1	power_station_generic	36%	0%	-	70%	263.44	-0.40	2031	642.19	83.05	85.00
mid -d recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		263.96	-0.39	2031	514.65	96.27	38.40
lo recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	265.01	-0.41	2031	579.97	109.48	42.28

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	265.01	-0.41	2031	579.28	109.48	42.10
mid -f recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	265.23	-0.44	2031	595.57	105.12	50.73
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	265.48	-0.46	2031	526.48	96.27	41.49
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	266.83	-0.33	2031	599.19	119.76	37.03
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	266.83	-0.33	2031	598.25	119.76	36.78
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	267.48	-0.37	2031	554.23	96.27	48.75
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	267.48	-0.37	2031	553.91	96.27	48.67
hi recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	hi	MHT 2	power_station_generic	36%	0%	-	55%	267.54	-0.43	2031	618.31	119.76	42.03
lo recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	lo	MHT 2	ATT_generic	30%	0%	-	64%	267.59	-0.37	2031	602.59	109.48	48.20
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	267.92	-0.41	2031	597.87	105.12	51.33
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	268.33	-0.32	2031	572.52	105.12	44.70
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	268.33	-0.32	2031	571.94	105.12	44.54
NC recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	NC	MHT 2	ATT_generic	30%	0%	-	70%	269.14	-0.24	2031	641.10	83.05	84.71
NC recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	269.76	-0.28	2031	644.33	83.05	85.55
lo recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	lo	MHT 1	power_station_generic	36%	0%	-	64%	269.90	-0.43	2031	607.14	109.48	49.39
hi recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	270.46	-0.41	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	270.46	-0.41	2031	602.17	119.76	37.81
lo recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		270.70	-0.36	2031	571.31	109.48	40.01
NC recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	NC	MHT 2	ATT_generic	30%	0%	-	70%	271.12	-0.24	2020	642.20	83.05	85.00
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	271.32	-0.27	2031	645.86	83.05	85.96

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
NC recycling, MHT 2, SRF to Gasification 1	52%	70%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
lo recycling, Incineration 4 (high CHP)_total	74%	57%
NC recycling, MHT 2, SRF to Gasification 1	52%	70%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	271.32	-0.27	2031	645.69	83.05	85.91
mid -d recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		273.11	-0.39	2031	514.64	96.27	38.39
NC recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	273.62	-0.27	2031	645.43	83.05	85.84
hi recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	hi	MHT 1	power_station_generic	36%	0%	-	55%	274.35	-0.44	2031	612.17	119.76	40.43
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	68%	274.63	-0.21	2020	596.80	83.05	73.12
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	68%	274.63	-0.21	2020	596.63	83.05	73.07
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	275.88	-0.34	2031	527.31	96.27	41.71
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	275.88	-0.34	2031	526.99	96.27	41.62
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	276.88	-0.37	2031	547.78	96.27	47.06
lo recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	lo	MHT 2	power_station_generic	36%	0%	-	64%	277.57	-0.45	2031	607.11	109.48	49.38
NC recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	NC	MHT 2	ATT_generic	30%	0%	-	70%	277.76	-0.24	2020	642.19	83.05	85.00
mid -f recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		278.65	-0.37	2031	554.16	105.12	39.89
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	279.12	-0.47	2031	595.36	119.76	36.03
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	279.38	-0.46	2031	567.22	105.12	43.31
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	279.71	-0.31	2031	577.01	109.48	41.50
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	279.71	-0.31	2031	576.31	109.48	41.32
lo recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	lo	MHT 2	ATT_generic	30%	0%	-	64%	280.90	-0.35	2031	607.14	109.48	49.39
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MHT 2	incineration_generic	30%	0%	-	70%	282.76	-0.23	2020	642.63	83.05	85.11
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MHT 2	incineration_generic	30%	0%	-	70%	282.76	-0.23	2020	642.46	83.05	85.07
mid -f recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		282.86	-0.35	2031	557.97	105.12	40.89

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	46%	68%
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	46%	68%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
NC recycling, MHT 2, SRF to Gasification 1	52%	70%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	52%	70%
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	52%	70%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	282.95	-0.43	2031	549.87	96.27	47.61
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	283.08	-0.40	2031	619.41	119.76	42.32
lo recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		283.15	-0.30	2031	580.27	109.48	42.36
lo recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		283.15	-0.30	2031	579.58	109.48	42.18
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	283.52	-0.37	2031	606.69	109.48	49.27
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	284.50	-0.31	2031	597.07	105.12	51.12
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	284.50	-0.31	2031	596.48	105.12	50.97
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	NC	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	68%	284.93	-0.21	2020	595.27	83.05	72.72
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	285.01	-0.36	2031	549.88	96.27	47.62
hi recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	hi	MHT 2	ATT_generic	30%	0%	-	55%	285.16	-0.38	2031	612.17	119.76	40.43
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	NC	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	68%	286.43	-0.21	2020	596.37	83.05	73.00
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	286.76	-0.45	2031	571.03	105.12	44.30
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	286.92	-0.36	2031	524.39	96.27	40.94
NC recycling, MBT aerobic 4, SRF to Gasification 1	Aerobic Digestion	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	287.15	-0.27	2031	645.42	83.05	85.84
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	287.31	-0.35	2031	562.03	109.48	37.58
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	287.31	-0.35	2031	561.33	109.48	37.40
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	287.47	-0.38	2031	594.06	105.12	50.33
hi recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MBT aerobic 1	power_station_generic	36%	0%	-	33%	288.55	-0.39	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MBT aerobic 1	power_station_generic	36%	0%	-	33%	288.55	-0.39	2031	602.17	119.76	37.81
mid -d recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	288.74	-0.37	2031	549.87	96.27	47.61

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	46%	68%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	46%	68%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
hi recycling, MBT aerobic 1, SRF to power_station_generic	78%	33%
hi recycling, MBT aerobic 1, SRF to power_station_generic	78%	33%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	289.12	-0.38	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	289.12	-0.38	2031	579.28	109.48	42.10
hi recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	289.69	-0.37	2031	625.55	119.76	43.93
mid -f recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	289.82	-0.43	2031	591.76	105.12	49.73
hi recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	290.21	-0.35	2031	586.63	119.76	33.74
hi recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	290.21	-0.35	2031	585.69	119.76	33.50
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	290.25	-0.35	2031	578.64	109.48	41.93
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	290.75	-0.42	2031	551.30	96.27	47.99
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	291.38	-0.45	2031	583.15	109.48	43.11
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	NC	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	68%	291.80	-0.21	2020	596.36	83.05	73.00
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	292.86	-0.35	2031	526.49	96.27	41.49
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	293.03	-0.44	2031	601.50	119.76	37.63
mid -d recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	293.12	-0.37	2031	547.78	96.27	47.06
NC recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MHT 1	ATT_generic	30%	0%	-	70%	293.47	-0.22	2020	642.63	83.05	85.11
NC recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MHT 1	ATT_generic	30%	0%	-	70%	293.47	-0.22	2020	642.46	83.05	85.07
hi recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		293.58	-0.39	2031	586.10	119.76	33.60
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MHT 2	incineration_generic	30%	0%	-	64%	294.49	-0.36	2031	602.59	109.48	48.20
hi recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	hi	MHT 1	power_station_generic	36%	0%	-	55%	294.73	-0.41	2031	618.31	119.76	42.03
lo recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		295.09	-0.29	2031	528.56	109.48	28.83
lo recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		295.09	-0.29	2031	527.87	109.48	28.65

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
NC recycling, MBT AD 2 (SRF), SRF to Gasification 1	46%	68%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
NC recycling, MHT 1, SRF to Gasification 1	52%	70%
NC recycling, MHT 1, SRF to Gasification 1	52%	70%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
lo recycling, Gasification Gas Engine 2_total	74%	57%
lo recycling, Gasification Gas Engine 2_total	74%	57%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		296.32	-0.28	2031	555.16	109.48	35.79
lo recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		296.32	-0.28	2031	554.46	109.48	35.60
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	296.50	-0.30	2031	572.52	105.12	44.70
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	296.50	-0.30	2031	571.94	105.12	44.54
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MHT 2	incineration_generic	30%	0%	-	70%	296.61	-0.23	2020	641.10	83.05	84.71
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	297.22	-0.27	2031	644.33	83.05	85.55
mid -f recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		298.42	-0.35	2031	557.94	105.12	40.88
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MHT 2	incineration_generic	30%	0%	-	70%	298.57	-0.23	2020	642.20	83.05	85.00
lo recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MBT aerobic 3	ATT_generic	30%	0%	-	43%	299.18	-0.30	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MBT aerobic 3	ATT_generic	30%	0%	-	43%	299.18	-0.30	2031	579.28	109.48	42.10
hi recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MBT aerobic 3	ATT_generic	30%	0%	-	33%	299.52	-0.31	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MBT aerobic 3	ATT_generic	30%	0%	-	33%	299.52	-0.31	2031	602.17	119.76	37.81
lo recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	lo	MHT 1	ATT_generic	30%	0%	-	64%	300.11	-0.36	2031	602.59	109.48	48.20
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	300.71	-0.33	2031	583.18	109.48	43.12
mid -f recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	300.81	-0.41	2031	595.57	105.12	50.73
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	301.04	-0.27	2031	645.43	83.05	85.84
mid -f recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	301.52	-0.44	2031	595.55	105.12	50.72
hi recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		301.55	-0.36	2031	592.24	119.76	35.21
mid -f recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	301.61	-0.35	2031	591.76	105.12	49.73
mid -d recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	302.71	-0.36	2031	549.88	96.27	47.62

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, True Pyrolysis 1_total	74%	57%
lo recycling, True Pyrolysis 1_total	74%	57%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	52%	70%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, MBT aerobic 3, SRF to Gasification 1	71%	43%
lo recycling, MBT aerobic 3, SRF to Gasification 1	71%	43%
hi recycling, MBT aerobic 3, SRF to Gasification 1	78%	33%
hi recycling, MBT aerobic 3, SRF to Gasification 1	78%	33%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	68%	303.25	-0.19	2015	596.80	83.05	73.12
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	68%	303.25	-0.19	2015	596.63	83.05	73.07
lo recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	303.30	-0.42	2031	606.67	109.48	49.26
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	304.45	-0.41	2031	553.40	96.27	48.54
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MHT 2	incineration_generic	30%	0%	-	70%	306.05	-0.23	2020	642.19	83.05	85.00
hi recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	hi	MHT 2	ATT_generic	30%	0%	-	55%	306.25	-0.35	2031	618.31	119.76	42.03
lo recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		307.37	-0.29	2031	542.15	109.48	32.38
lo recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		307.37	-0.29	2031	541.46	109.48	32.20
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	307.61	-0.36	2031	597.87	105.12	51.33
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MHT 2	incineration_generic	30%	0%	-	64%	307.67	-0.34	2031	607.14	109.48	49.39
hi recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		308.92	-0.31	2031	600.05	119.76	37.25
hi recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		308.92	-0.31	2031	599.11	119.76	37.01
NC recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	NC	MHT 1	ATT_generic	30%	0%	-	70%	310.23	-0.23	2020	641.10	83.05	84.71
hi recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	hi	MHT 1	ATT_generic	30%	0%	-	55%	312.16	-0.38	2031	612.17	119.76	40.43
NC recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	NC	MHT 1	ATT_generic	30%	0%	-	70%	312.51	-0.22	2020	642.20	83.05	85.00
mid -f recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	313.00	-0.33	2031	595.57	105.12	50.73
lo recycling, Gasification 1_total	Wet AD with biogas to transport fuel	lo	Gasification 1_total	#N/A	30%	0%	57%		313.64	-0.28	2031	467.41	109.48	12.82
lo recycling, Gasification 1_total	Wet AD with biogas to grid injection	lo	Gasification 1_total	#N/A	30%	0%	57%		313.64	-0.28	2031	466.71	109.48	12.64
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MHT 2	incineration_generic	30%	0%	-	55%	313.65	-0.38	2031	612.17	119.76	40.43
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	68%	314.51	-0.19	2020	595.27	83.05	72.72

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	46%	68%
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	46%	68%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%
NC recycling, MHT 2, SRF to Incineration 1 (electricity only)	52%	70%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
lo recycling, Gasification Gas Engine 1_total	74%	57%
lo recycling, Gasification Gas Engine 1_total	74%	57%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%
NC recycling, MHT 1, SRF to Gasification 1	52%	70%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
NC recycling, MHT 1, SRF to Gasification 1	52%	70%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
lo recycling, Gasification 1_total	74%	57%
lo recycling, Gasification 1_total	74%	57%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	46%	68%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	314.66	-0.37	2031	625.55	119.76	43.93
lo recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	lo	MHT 1	ATT_generic	30%	0%	-	64%	315.03	-0.34	2031	607.14	109.48	49.39
NC recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	NC	Incineration 3 (medium CHP)_total	#N/A	20%	20%	62%		315.45	-0.18	2015	581.24	83.05	69.05
NC recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	NC	Incineration 3 (medium CHP)_total	#N/A	20%	20%	62%		315.45	-0.18	2015	581.07	83.05	69.00
hi recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	hi	Gasification Gas Engine 2_total	#N/A	32%	0%	47%		315.92	-0.30	2031	561.00	119.76	27.04
hi recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	hi	Gasification Gas Engine 2_total	#N/A	32%	0%	47%		315.92	-0.30	2031	560.07	119.76	26.79
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	68%	315.99	-0.19	2015	596.37	83.05	73.00
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	316.21	-0.45	2031	571.00	105.12	44.30
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	316.24	-0.37	2031	594.06	105.12	50.33
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	316.27	-0.27	2031	645.42	83.05	85.84
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	316.54	-0.35	2031	524.39	96.27	40.94
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	316.65	-0.35	2031	526.48	96.27	41.49
hi recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	hi	True Pyrolysis 1_total	#N/A	32%	0%	47%		316.87	-0.29	2031	581.08	119.76	32.29
hi recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	hi	True Pyrolysis 1_total	#N/A	32%	0%	47%		316.87	-0.29	2031	580.14	119.76	32.05
hi recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MBT aerobic 1	ATT_generic	30%	0%	-	33%	317.57	-0.30	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MBT aerobic 1	ATT_generic	30%	0%	-	33%	317.57	-0.30	2031	602.17	119.76	37.81
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	317.68	-0.36	2031	549.87	96.27	47.61
NC recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	318.41	-0.28	2031	546.42	83.05	59.93
NC recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	318.41	-0.28	2031	546.25	83.05	59.89
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	318.79	-0.37	2031	595.36	119.76	36.03

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
NC recycling, Incineration 3 (medium CHP)_total	46%	62%
NC recycling, Incineration 3 (medium CHP)_total	46%	62%
hi recycling, Gasification Gas Engine 2_total	80%	47%
hi recycling, Gasification Gas Engine 2_total	80%	47%
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	46%	68%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
hi recycling, True Pyrolysis 1_total	80%	47%
hi recycling, True Pyrolysis 1_total	80%	47%
hi recycling, MBT aerobic 1, SRF to Gasification 1	78%	33%
hi recycling, MBT aerobic 1, SRF to Gasification 1	78%	33%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	319.30	-0.40	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	319.30	-0.40	2031	567.18	105.12	43.30
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	320.03	-0.34	2031	578.64	109.48	41.93
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	320.34	-0.34	2031	549.22	105.12	38.60
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	320.34	-0.34	2031	548.64	105.12	38.45
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	Dirty MRF 1	incineration_generic	30%	0%	-	52%	320.62	-0.34	2031	586.63	119.76	33.74
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	Dirty MRF 1	incineration_generic	30%	0%	-	52%	320.62	-0.34	2031	585.69	119.76	33.50
NC recycling, MHT 1, SRF to Gasification 1	Aerobic Digestion	NC	MHT 1	ATT_generic	30%	0%	-	70%	321.84	-0.22	2020	642.19	83.05	85.00
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	68%	322.06	-0.19	2015	596.36	83.05	73.00
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	322.44	-0.34	2031	526.49	96.27	41.49
lo recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	lo	MHT 1	power_station_generic	36%	0%	-	64%	322.46	-0.43	2031	607.11	109.48	49.38
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	322.82	-0.36	2031	547.78	96.27	47.06
NC recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	NC	Incineration 3 (medium CHP)_total	#N/A	20%	20%	62%		323.31	-0.19	2015	579.71	83.05	68.64
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MHT 1	incineration_generic	30%	0%	-	70%	323.64	-0.21	2020	642.63	83.05	85.11
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MHT 1	incineration_generic	30%	0%	-	70%	323.64	-0.21	2020	642.46	83.05	85.07
lo recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MBT aerobic 1	ATT_generic	30%	0%	-	43%	324.16	-0.29	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MBT aerobic 1	ATT_generic	30%	0%	-	43%	324.16	-0.29	2031	579.28	109.48	42.10
NC recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	NC	Incineration 3 (medium CHP)_total	#N/A	20%	20%	62%		324.31	-0.18	2015	580.81	83.05	68.93
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	325.84	-0.33	2031	567.22	105.12	43.31
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	327.08	-0.34	2031	517.04	96.27	39.02

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	82%	52%
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	82%	52%
NC recycling, MHT 1, SRF to Gasification 1	52%	70%
NC recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	46%	68%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
NC recycling, Incineration 3 (medium CHP)_total	46%	62%
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	52%	70%
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, MBT aerobic 1, SRF to Gasification 1	71%	43%
lo recycling, MBT aerobic 1, SRF to Gasification 1	71%	43%
NC recycling, Incineration 3 (medium CHP)_total	46%	62%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	327.08	-0.34	2031	516.72	96.27	38.94
hi recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	hi	Gasification Gas Engine 1_total	#N/A	30%	0%	47%		327.17	-0.29	2031	571.26	119.76	29.72
hi recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	hi	Gasification Gas Engine 1_total	#N/A	30%	0%	47%		327.17	-0.29	2031	570.33	119.76	29.48
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	327.53	-0.30	2031	564.30	105.12	42.54
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	327.53	-0.30	2031	563.72	105.12	42.39
mid -d recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		327.94	-0.33	2031	522.68	96.27	40.50
mid -d recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		327.94	-0.33	2031	522.36	96.27	40.41
NC recycling, Incineration 3 (medium CHP)_total	Aerobic Digestion	NC	Incineration 3 (medium CHP)_total	#N/A	20%	20%	62%		328.48	-0.18	2015	580.80	83.05	68.93
lo recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	328.77	-0.38	2031	555.70	109.48	35.93
NC recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	330.16	-0.28	2031	544.89	83.05	59.53
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MHT 1	incineration_generic	30%	0%	-	64%	330.37	-0.35	2031	602.59	109.48	48.20
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	330.39	-0.32	2031	583.18	109.48	43.12
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT aerobic 3	incineration_generic	30%	0%	-	43%	330.52	-0.29	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT aerobic 3	incineration_generic	30%	0%	-	43%	330.52	-0.29	2031	579.28	109.48	42.10
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT aerobic 3	incineration_generic	30%	0%	-	33%	331.08	-0.30	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT aerobic 3	incineration_generic	30%	0%	-	33%	331.08	-0.30	2031	602.17	119.76	37.81
NC recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	331.63	-0.28	2031	545.99	83.05	59.82
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	332.15	-0.34	2031	591.76	105.12	49.73
mid -f recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		332.30	-0.29	2031	566.92	105.12	43.23
mid -f recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		332.30	-0.29	2031	566.34	105.12	43.08

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%
hi recycling, Gasification Gas Engine 1_total	80%	47%
hi recycling, Gasification Gas Engine 1_total	80%	47%
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	51%
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	51%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
NC recycling, Incineration 3 (medium CHP)_total	46%	62%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	71%	43%
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	71%	43%
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	78%	33%
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	78%	33%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	332.31	-0.35	2031	549.88	96.27	47.62
lo recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	lo	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		332.78	-0.27	2031	582.87	109.48	43.04
lo recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	lo	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		332.78	-0.27	2031	582.17	109.48	42.85
hi recycling, Gasification 1_total	Wet AD with biogas to transport fuel	hi	Gasification 1_total	#N/A	30%	0%	47%		332.87	-0.29	2031	514.83	119.76	14.95
hi recycling, Gasification 1_total	Wet AD with biogas to grid injection	hi	Gasification 1_total	#N/A	30%	0%	47%		332.87	-0.29	2031	513.89	119.76	14.71
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	334.41	-0.32	2031	571.03	105.12	44.30
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MHT 2	incineration_generic	30%	0%	-	55%	334.57	-0.35	2031	618.31	119.76	42.03
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	334.60	-0.34	2031	601.50	119.76	37.63
lo recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		335.20	-0.32	2031	573.94	109.48	40.70
hi recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	hi	MHT 1	ATT_generic	30%	0%	-	55%	335.24	-0.35	2031	618.31	119.76	42.03
hi recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		335.95	-0.36	2031	592.20	119.76	35.20
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	336.21	-0.35	2031	597.87	105.12	51.33
NC recycling, Dirty MRF 1, SRF to Gasification 1	Aerobic Digestion	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	338.05	-0.28	2031	545.98	83.05	59.82
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	338.44	-0.38	2031	551.30	96.27	47.99
lo recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	lo	MHT 2	ATT_generic	30%	0%	-	64%	339.07	-0.35	2031	607.11	109.48	49.38
lo recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	339.29	-0.36	2031	560.24	109.48	37.12
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	340.52	-0.36	2031	507.85	96.27	36.62
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	340.52	-0.36	2031	507.53	96.27	36.53
mid -f recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	340.53	-0.34	2031	591.76	105.12	49.73
NC recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	340.54	-0.35	2031	588.97	83.05	71.07

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
lo recycling, Incineration 2 (low CHP)_total	74%	57%
lo recycling, Incineration 2 (low CHP)_total	74%	57%
hi recycling, Gasification 1_total	80%	47%
hi recycling, Gasification 1_total	80%	47%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	340.54	-0.35	2031	588.80	83.05	71.02
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MHT 1	incineration_generic	30%	0%	-	70%	341.91	-0.21	2020	641.10	83.05	84.71
lo recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		342.55	-0.30	2031	578.49	109.48	41.89
lo recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	343.17	-0.43	2031	573.64	109.48	40.62
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	343.42	-0.32	2031	595.57	105.12	50.73
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MHT 1	incineration_generic	30%	0%	-	55%	343.48	-0.37	2031	612.17	119.76	40.43
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MHT 1	incineration_generic	30%	0%	-	70%	344.17	-0.21	2020	642.20	83.05	85.00
NC recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	NC	Gasification Gas Engine 2_total	#N/A	32%	0%	62%		344.43	-0.16	2015	474.31	83.05	41.06
NC recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	NC	Gasification Gas Engine 2_total	#N/A	32%	0%	62%		344.43	-0.16	2015	474.14	83.05	41.02
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MHT 1	incineration_generic	30%	0%	-	64%	345.16	-0.33	2031	607.14	109.48	49.39
mid -d recycling, MHT 1, SRF to Gasification 1	Aerobic Digestion	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	345.66	-0.36	2031	549.87	96.27	47.61
lo recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to transport fuel	lo	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		346.34	-0.27	2031	523.66	109.48	27.54
lo recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to grid injection	lo	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		346.34	-0.27	2031	522.97	109.48	27.36
NC recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	NC	True Pyrolysis 1_total	#N/A	32%	0%	62%		346.89	-0.14	2015	529.30	83.05	55.45
NC recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	NC	True Pyrolysis 1_total	#N/A	32%	0%	62%		346.89	-0.14	2015	529.13	83.05	55.41
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	347.32	-0.41	2031	597.85	105.12	51.32
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	348.01	-0.33	2031	583.15	109.48	43.11
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	349.19	-0.34	2031	526.48	96.27	41.49
mid -f recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		349.83	-0.28	2031	513.02	105.12	29.13
mid -f recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		349.83	-0.28	2031	512.44	105.12	28.97

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	52%	70%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	52%	70%
NC recycling, Gasification Gas Engine 2_total	46%	62%
NC recycling, Gasification Gas Engine 2_total	46%	62%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
lo recycling, Incineration 1 (electricity only)_total	74%	57%
lo recycling, Incineration 1 (electricity only)_total	74%	57%
NC recycling, True Pyrolysis 1_total	46%	62%
NC recycling, True Pyrolysis 1_total	46%	62%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -f recycling, Gasification Gas Engine 2_total	73%	52%
mid -f recycling, Gasification Gas Engine 2_total	73%	52%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 3	power_station_generic	36%	0%	-	40%	349.84	-0.40	2031	519.91	96.27	39.77
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MBT aerobic 3	power_station_generic	36%	0%	-	40%	349.84	-0.40	2031	519.59	96.27	39.69
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	61%	349.91	-0.18	2015	580.90	83.05	68.96
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	61%	349.91	-0.18	2015	580.73	83.05	68.91
mid -d recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		349.92	-0.33	2031	470.62	96.27	26.88
mid -d recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		349.92	-0.33	2031	470.30	96.27	26.79
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	350.42	-0.37	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	350.42	-0.37	2031	567.18	105.12	43.30
mid -f recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	351.04	-0.41	2031	595.55	105.12	50.72
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	351.11	-0.26	2031	546.42	83.05	59.93
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	351.11	-0.26	2031	546.25	83.05	59.89
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT aerobic 1	incineration_generic	30%	0%	-	33%	351.16	-0.29	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT aerobic 1	incineration_generic	30%	0%	-	33%	351.16	-0.29	2031	602.17	119.76	37.81
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	351.45	-0.36	2031	595.36	119.76	36.03
mid -f recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		351.51	-0.27	2031	540.74	105.12	36.38
mid -f recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		351.51	-0.27	2031	540.16	105.12	36.23
mid -d recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		351.89	-0.32	2031	497.39	96.27	33.88
mid -d recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		351.89	-0.32	2031	497.07	96.27	33.80
hi recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	hi	MHT 2	power_station_generic	36%	0%	-	55%	352.57	-0.43	2031	618.27	119.76	42.02
mid -f recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	353.39	-0.32	2031	595.57	105.12	50.73

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	69%	40%
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	69%	40%
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	41%	61%
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	41%	61%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	68%	38%
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	68%	38%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	78%	33%
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	78%	33%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
mid -f recycling, True Pyrolysis 1_total	73%	52%
mid -f recycling, True Pyrolysis 1_total	73%	52%
mid -d recycling, True Pyrolysis 1_total	74%	57%
mid -d recycling, True Pyrolysis 1_total	74%	57%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	353.69	-0.33	2031	549.22	105.12	38.60
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	353.69	-0.33	2031	548.64	105.12	38.45
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	354.32	-0.37	2031	553.40	96.27	48.54
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MHT 1	incineration_generic	30%	0%	-	70%	354.62	-0.21	2020	642.19	83.05	85.00
NC recycling, Gasification Gas Engine 2_total	Wet AD with electricity generation	NC	Gasification Gas Engine 2_total	#N/A	32%	0%	62%		354.94	-0.17	2015	472.77	83.05	40.66
lo recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	354.96	-0.41	2031	578.19	109.48	41.81
hi recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	hi	Incineration 2 (low CHP)_total	#N/A	22%	10%	47%		355.46	-0.28	2031	602.00	119.76	37.77
hi recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	hi	Incineration 2 (low CHP)_total	#N/A	22%	10%	47%		355.46	-0.28	2031	601.07	119.76	37.52
NC recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	355.89	-0.36	2031	587.44	83.05	70.67
NC recycling, Gasification Gas Engine 2_total	Dry AD with electricity generation	NC	Gasification Gas Engine 2_total	#N/A	32%	0%	62%		356.16	-0.16	2015	473.88	83.05	40.95
NC recycling, True Pyrolysis 1_total	Wet AD with electricity generation	NC	True Pyrolysis 1_total	#N/A	32%	0%	62%		357.60	-0.14	2015	527.76	83.05	55.05
NC recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	357.70	-0.35	2031	588.54	83.05	70.96
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT aerobic 1	incineration_generic	30%	0%	-	43%	358.28	-0.28	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT aerobic 1	incineration_generic	30%	0%	-	43%	358.28	-0.28	2031	579.28	109.48	42.10
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	358.29	-0.44	2031	601.46	119.76	37.62
NC recycling, True Pyrolysis 1_total	Dry AD with electricity generation	NC	True Pyrolysis 1_total	#N/A	32%	0%	62%		358.83	-0.14	2015	528.86	83.05	55.34
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	359.47	-0.32	2031	567.22	105.12	43.31
mid -d recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		359.53	-0.34	2031	519.75	96.27	39.73
lo recycling, Gasification Gas Engine 2_total	Wet AD with electricity generation	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		359.96	-0.31	2031	522.23	109.48	27.17
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	361.72	-0.33	2031	570.68	109.48	39.85

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	58%
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	58%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
NC recycling, MHT 1, SRF to Incineration 1 (electricity only)	52%	70%
NC recycling, Gasification Gas Engine 2_total	46%	62%
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%
hi recycling, Incineration 2 (low CHP)_total	80%	47%
hi recycling, Incineration 2 (low CHP)_total	80%	47%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
NC recycling, Gasification Gas Engine 2_total	46%	62%
NC recycling, True Pyrolysis 1_total	46%	62%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	71%	43%
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	71%	43%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
NC recycling, True Pyrolysis 1_total	46%	62%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
lo recycling, Gasification Gas Engine 2_total	74%	57%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, Gasification Gas Engine 2_total	Aerobic Digestion	NC	Gasification Gas Engine 2_total	#N/A	32%	0%	62%		361.96	-0.16	2015	473.87	83.05	40.95
lo recycling, True Pyrolysis 1_total	Wet AD with electricity generation	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		362.13	-0.30	2031	548.83	109.48	34.13
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	362.17	-0.37	2031	555.70	109.48	35.93
mid -d recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		363.38	-0.33	2031	521.86	96.27	40.28
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	363.91	-0.27	2031	544.89	83.05	59.53
NC recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	NC	Gasification Gas Engine 1_total	#N/A	30%	0%	62%		364.20	-0.15	2015	502.41	83.05	48.42
NC recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	NC	Gasification Gas Engine 1_total	#N/A	30%	0%	62%		364.20	-0.15	2015	502.24	83.05	48.37
NC recycling, True Pyrolysis 1_total	Aerobic Digestion	NC	True Pyrolysis 1_total	#N/A	32%	0%	62%		364.76	-0.14	2015	528.86	83.05	55.34
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	61%	364.98	-0.18	2015	579.37	83.05	68.56
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 3	ATT_generic	30%	0%	-	38%	365.24	-0.28	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MBT aerobic 3	ATT_generic	30%	0%	-	38%	365.24	-0.28	2031	567.18	105.12	43.30
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	365.36	-0.26	2031	545.99	83.05	59.82
mid -f recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		365.58	-0.27	2031	527.19	105.12	32.83
mid -f recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		365.58	-0.27	2031	526.60	105.12	32.68
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MHT 1	incineration_generic	30%	0%	-	55%	366.40	-0.34	2031	618.31	119.76	42.03
NC recycling, MBT aerobic 3, SRF to power_station_generic	Aerobic Digestion	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	366.40	-0.35	2031	588.53	83.05	70.95
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	61%	366.70	-0.18	2015	580.47	83.05	68.84
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	367.14	-0.33	2031	601.50	119.76	37.63
mid -d recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	mid -d	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		367.23	-0.32	2031	484.30	96.27	30.45
mid -d recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	mid -d	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		367.23	-0.32	2031	483.98	96.27	30.37

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, Gasification Gas Engine 2_total	46%	62%
lo recycling, True Pyrolysis 1_total	74%	57%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
NC recycling, Gasification Gas Engine 1_total	46%	62%
NC recycling, Gasification Gas Engine 1_total	46%	62%
NC recycling, True Pyrolysis 1_total	46%	62%
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	41%	61%
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	69%	38%
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	69%	38%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
mid -f recycling, Gasification Gas Engine 1_total	73%	52%
mid -f recycling, Gasification Gas Engine 1_total	73%	52%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	41%	61%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
mid -d recycling, Gasification Gas Engine 1_total	74%	57%
mid -d recycling, Gasification Gas Engine 1_total	74%	57%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to transport fuel	hi	Incineration 1 (electricity only)_total	#N/A	30%	0%	47%		367.84	-0.28	2031	557.30	119.76	26.07
hi recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to grid injection	hi	Incineration 1 (electricity only)_total	#N/A	30%	0%	47%		367.84	-0.28	2031	556.36	119.76	25.82
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	367.96	-0.30	2031	571.03	105.12	44.30
mid -f recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	368.33	-0.33	2031	595.55	105.12	50.72
lo recycling, Gasification Gas Engine 2_total	Dry AD with electricity generation	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		368.75	-0.29	2031	526.78	109.48	28.36
lo recycling, MBT aerobic 4, SRF to Gasification 1	Aerobic Digestion	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	370.45	-0.37	2031	606.67	109.48	49.26
lo recycling, True Pyrolysis 1_total	Dry AD with electricity generation	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		371.01	-0.28	2031	553.37	109.48	35.32
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	371.82	-0.41	2031	553.39	96.27	48.53
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	372.55	-0.26	2031	545.98	83.05	59.82
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	372.59	-0.35	2031	560.24	109.48	37.12
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MHT 2	incineration_generic	30%	0%	-	64%	372.66	-0.34	2031	607.11	109.48	49.38
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	372.74	-0.38	2031	551.30	96.27	47.99
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	373.44	-0.31	2031	575.22	109.48	41.04
mid -f recycling, Gasification 1_total	Wet AD with biogas to transport fuel	mid -f	Gasification 1_total	#N/A	30%	0%	52%		373.66	-0.27	2031	449.28	105.12	12.45
mid -f recycling, Gasification 1_total	Wet AD with biogas to grid injection	mid -f	Gasification 1_total	#N/A	30%	0%	52%		373.66	-0.27	2031	448.70	105.12	12.29
NC recycling, Gasification 1_total	Wet AD with biogas to transport fuel	NC	Gasification 1_total	#N/A	30%	0%	62%		374.54	-0.14	2015	347.84	83.05	7.97
NC recycling, Gasification 1_total	Wet AD with biogas to grid injection	NC	Gasification 1_total	#N/A	30%	0%	62%		374.54	-0.14	2015	347.67	83.05	7.93
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	375.12	-0.33	2031	591.76	105.12	49.73
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	61%	375.27	-0.18	2015	580.46	83.05	68.84
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	Dirty MRF 1	incineration_generic	30%	0%	-	61%	375.82	-0.35	2031	507.85	96.27	36.62

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, Incineration 1 (electricity only)_total	80%	47%
hi recycling, Incineration 1 (electricity only)_total	80%	47%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
lo recycling, Gasification Gas Engine 2_total	74%	57%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
lo recycling, True Pyrolysis 1_total	74%	57%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%
mid -f recycling, Gasification 1_total	73%	52%
mid -f recycling, Gasification 1_total	73%	52%
NC recycling, Gasification 1_total	46%	62%
NC recycling, Gasification 1_total	46%	62%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
NC recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	41%	61%
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	61%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	Dirty MRF 1	incineration_generic	30%	0%	-	61%	375.82	-0.35	2031	507.53	96.27	36.53
NC recycling, Gasification Gas Engine 1_total	Wet AD with electricity generation	NC	Gasification Gas Engine 1_total	#N/A	30%	0%	62%		375.97	-0.15	2015	500.87	83.05	48.02
mid -d recycling, Gasification 1_total	Wet AD with biogas to transport fuel	mid -d	Gasification 1_total	#N/A	30%	0%	57%		376.18	-0.32	2031	409.06	96.27	10.76
mid -d recycling, Gasification 1_total	Wet AD with biogas to grid injection	mid -d	Gasification 1_total	#N/A	30%	0%	57%		376.18	-0.32	2031	408.74	96.27	10.68
NC recycling, Gasification Gas Engine 1_total	Dry AD with electricity generation	NC	Gasification Gas Engine 1_total	#N/A	30%	0%	62%		377.26	-0.15	2015	501.97	83.05	48.30
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	377.32	-0.32	2031	571.00	105.12	44.30
lo recycling, Gasification Gas Engine 1_total	Wet AD with electricity generation	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		378.40	-0.31	2031	535.82	109.48	30.73
hi recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	378.77	-0.44	2031	594.56	119.76	35.82
lo recycling, Incineration 3 (medium CHP)_total	Aerobic Digestion	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		379.65	-0.30	2031	578.46	109.48	41.88
mid -f recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		380.06	-0.31	2031	561.61	105.12	41.84
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	380.12	-0.36	2031	590.64	119.76	34.79
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	380.30	-0.35	2031	549.87	96.27	47.61
mid -d recycling, Incineration 3 (medium CHP)_total	Aerobic Digestion	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		383.03	-0.33	2031	521.84	96.27	40.28
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	383.39	-0.32	2031	583.15	109.48	43.11
NC recycling, Gasification Gas Engine 1_total	Aerobic Digestion	NC	Gasification Gas Engine 1_total	#N/A	30%	0%	62%		383.88	-0.15	2015	501.97	83.05	48.30
lo recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with electricity generation	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	384.71	-0.41	2031	573.64	109.48	40.62
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 1	power_station_generic	36%	0%	-	40%	385.67	-0.38	2031	519.91	96.27	39.77
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MBT aerobic 1	power_station_generic	36%	0%	-	40%	385.67	-0.38	2031	519.59	96.27	39.69
mid -f recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		385.80	-0.29	2031	565.43	105.12	42.84
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	385.84	-0.35	2031	514.12	96.27	38.26

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	61%
NC recycling, Gasification Gas Engine 1_total	46%	62%
mid -d recycling, Gasification 1_total	74%	57%
mid -d recycling, Gasification 1_total	74%	57%
NC recycling, Gasification Gas Engine 1_total	46%	62%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
lo recycling, Gasification Gas Engine 1_total	74%	57%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
NC recycling, Gasification Gas Engine 1_total	46%	62%
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	69%	40%
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	69%	40%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	386.95	-0.37	2031	504.93	96.27	35.85
NC recycling, Gasification 1_total	Wet AD with electricity generation	NC	Gasification 1_total	#N/A	30%	0%	62%		387.00	-0.15	2015	346.30	83.05	7.57
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	387.18	-0.36	2031	543.92	105.12	37.21
lo recycling, Gasification Gas Engine 1_total	Dry AD with electricity generation	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		387.64	-0.29	2031	540.37	109.48	31.92
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	387.85	-0.31	2031	595.57	105.12	50.73
lo recycling, Gasification 1_total	Wet AD with electricity generation	lo	Gasification 1_total	#N/A	30%	0%	57%		387.95	-0.30	2031	461.08	109.48	11.17
NC recycling, Gasification 1_total	Dry AD with electricity generation	NC	Gasification 1_total	#N/A	30%	0%	62%		388.33	-0.14	2015	347.40	83.05	7.86
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	388.48	-0.37	2031	553.40	96.27	48.54
NC recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MBT aerobic 1	power_station_generic	36%	0%	-	50%	388.71	-0.31	2031	588.97	83.05	71.07
NC recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MBT aerobic 1	power_station_generic	36%	0%	-	50%	388.71	-0.31	2031	588.80	83.05	71.02
mid -d recycling, Gasification Gas Engine 2_total	Wet AD with electricity generation	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		390.75	-0.34	2031	467.70	96.27	26.11
hi recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		390.85	-0.34	2031	591.50	119.76	35.02
NC recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	NC	Incineration 2 (low CHP)_total	#N/A	22%	10%	62%		390.93	-0.12	-	586.60	83.05	70.45
NC recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	NC	Incineration 2 (low CHP)_total	#N/A	22%	10%	62%		390.93	-0.12	-	586.43	83.05	70.40
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	392.40	-0.36	2031	507.03	96.27	36.40
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	393.02	-0.34	2031	516.22	96.27	38.81
mid -d recycling, True Pyrolysis 1_total	Wet AD with electricity generation	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		393.41	-0.33	2031	494.47	96.27	33.11
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	393.58	-0.42	2031	562.45	105.12	42.06
lo recycling, Gasification 2_total	Wet AD with biogas to transport fuel	lo	Gasification 2_total	#N/A	21%	0%	57%		393.60	-0.25	2031	560.29	109.48	37.13
lo recycling, Gasification 2_total	Wet AD with biogas to grid injection	lo	Gasification 2_total	#N/A	21%	0%	57%		393.60	-0.25	2031	559.60	109.48	36.95

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
NC recycling, Gasification 1_total	46%	62%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
lo recycling, Gasification Gas Engine 1_total	74%	57%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
lo recycling, Gasification 1_total	74%	57%
NC recycling, Gasification 1_total	46%	62%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
NC recycling, MBT aerobic 1, SRF to power_station_generic	38%	50%
NC recycling, MBT aerobic 1, SRF to power_station_generic	38%	50%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%
NC recycling, Incineration 2 (low CHP)_total	46%	62%
NC recycling, Incineration 2 (low CHP)_total	46%	62%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%
mid -d recycling, True Pyrolysis 1_total	74%	57%
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%
lo recycling, Gasification 2_total	74%	57%
lo recycling, Gasification 2_total	74%	57%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MHT 1, SRF to Gasification 1	Aerobic Digestion	lo	MHT 1	ATT_generic	30%	0%	-	64%	393.91	-0.34	2031	607.11	109.48	49.38
hi recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	394.78	-0.41	2031	600.70	119.76	37.43
lo recycling, Dirty MRF 1, SRF to Gasification 1	Aerobic Digestion	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	395.13	-0.36	2031	560.21	109.48	37.11
mid -f recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		395.17	-0.26	2031	569.62	105.12	43.94
mid -f recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		395.17	-0.26	2031	569.04	105.12	43.78
NC recycling, Gasification 1_total	Aerobic Digestion	NC	Gasification 1_total	#N/A	30%	0%	62%		395.39	-0.14	2015	347.40	83.05	7.86
mid -d recycling, Gasification Gas Engine 2_total	Dry AD with electricity generation	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		395.41	-0.33	2031	469.80	96.27	26.66
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	395.52	-0.34	2031	547.73	105.12	38.21
mid -d recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		395.96	-0.31	2031	525.29	96.27	41.18
mid -d recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	mid -d	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		395.96	-0.31	2031	524.97	96.27	41.10
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	397.09	-0.33	2031	596.78	119.76	36.40
hi recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	397.20	-0.38	2031	578.08	119.76	31.51
lo recycling, Gasification 1_total	Dry AD with electricity generation	lo	Gasification 1_total	#N/A	30%	0%	57%		397.43	-0.28	2031	465.62	109.48	12.36
lo recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	397.93	-0.38	2031	578.19	109.48	41.81
mid -d recycling, True Pyrolysis 1_total	Dry AD with electricity generation	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		398.13	-0.32	2031	496.57	96.27	33.66
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	398.36	-0.27	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	398.36	-0.27	2031	567.18	105.12	43.30
hi recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		401.45	-0.31	2031	597.64	119.76	36.62
lo recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with electricity generation	lo	MBT aerobic 3	ATT_generic	30%	0%	-	43%	402.11	-0.33	2031	573.64	109.48	40.62
hi recycling, Gasification 2_total	Wet AD with biogas to transport fuel	hi	Gasification 2_total	#N/A	21%	0%	47%		402.69	-0.26	2031	584.96	119.76	33.31

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
mid -f recycling, Incineration 2 (low CHP)_total	73%	52%
mid -f recycling, Incineration 2 (low CHP)_total	73%	52%
NC recycling, Gasification 1_total	46%	62%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
mid -d recycling, Incineration 2 (low CHP)_total	74%	57%
mid -d recycling, Incineration 2 (low CHP)_total	74%	57%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
lo recycling, Gasification 1_total	74%	57%
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
mid -d recycling, True Pyrolysis 1_total	74%	57%
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	69%	38%
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	69%	38%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%
lo recycling, MBT aerobic 3, SRF to Gasification 1	71%	43%
hi recycling, Gasification 2_total	80%	47%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, Gasification 2_total	Wet AD with biogas to grid injection	hi	Gasification 2_total	#N/A	21%	0%	47%		402.69	-0.26	2031	584.02	119.76	33.06
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	402.87	-0.40	2031	566.26	105.12	43.06
NC recycling, Incineration 2 (low CHP)_total	Wet AD with electricity generation	NC	Incineration 2 (low CHP)_total	#N/A	22%	10%	62%		403.07	-0.13	-	585.07	83.05	70.05
lo recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to transport fuel	lo	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		403.52	-0.24	2031	553.18	109.48	35.27
lo recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to grid injection	lo	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		403.52	-0.24	2031	552.49	109.48	35.09
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 3	incineration_generic	30%	0%	-	38%	403.54	-0.27	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT aerobic 3	incineration_generic	30%	0%	-	38%	403.54	-0.27	2031	567.18	105.12	43.30
NC recycling, Incineration 2 (low CHP)_total	Dry AD with electricity generation	NC	Incineration 2 (low CHP)_total	#N/A	22%	10%	62%		404.32	-0.12	-	586.17	83.05	70.33
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	405.12	-0.32	2031	595.55	105.12	50.72
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 3	ATT_generic	30%	0%	-	40%	405.77	-0.31	2031	519.91	96.27	39.77
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MBT aerobic 3	ATT_generic	30%	0%	-	40%	405.77	-0.31	2031	519.59	96.27	39.69
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	406.05	-0.37	2031	606.67	109.48	49.26
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	406.11	-0.32	2031	559.00	105.12	41.16
hi recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	hi	MHT 1	power_station_generic	36%	0%	-	55%	406.84	-0.41	2031	618.27	119.76	42.02
lo recycling, Incineration 2 (low CHP)_total	Wet AD with electricity generation	lo	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		407.08	-0.29	2031	576.54	109.48	41.38
NC recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with electricity generation	NC	MBT aerobic 1	power_station_generic	36%	0%	-	50%	408.85	-0.31	2031	587.44	83.05	70.67
NC recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MBT aerobic 3	ATT_generic	30%	0%	-	50%	409.66	-0.15	2015	588.97	83.05	71.07
NC recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MBT aerobic 3	ATT_generic	30%	0%	-	50%	409.66	-0.15	2015	588.80	83.05	71.02
mid -f recycling, Gasification Gas Engine 2_total	Wet AD with electricity generation	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		410.31	-0.30	2031	507.72	105.12	27.74
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MBT aerobic 3	power_station_generic	36%	0%	-	40%	410.52	-0.41	2031	516.98	96.27	39.00

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, Gasification 2_total	80%	47%
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%
NC recycling, Incineration 2 (low CHP)_total	46%	62%
lo recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
lo recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	38%
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	38%
NC recycling, Incineration 2 (low CHP)_total	46%	62%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	69%	40%
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	69%	40%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	51%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
lo recycling, Incineration 2 (low CHP)_total	74%	57%
NC recycling, MBT aerobic 1, SRF to power_station_generic	38%	50%
NC recycling, MBT aerobic 3, SRF to Gasification 1	39%	50%
NC recycling, MBT aerobic 3, SRF to Gasification 1	39%	50%
mid -f recycling, Gasification Gas Engine 2_total	73%	52%
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	69%	40%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	NC	MBT aerobic 1	power_station_generic	36%	0%	-	50%	410.92	-0.31	2031	588.54	83.05	70.96
NC recycling, Incineration 2 (low CHP)_total	Aerobic Digestion	NC	Incineration 2 (low CHP)_total	#N/A	22%	10%	62%		411.24	-0.12	-	586.16	83.05	70.33
hi recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	411.94	-0.35	2031	584.22	119.76	33.11
mid -d recycling, Gasification Gas Engine 1_total	Wet AD with electricity generation	mid -d	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		412.47	-0.33	2031	481.38	96.27	29.69
mid -f recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 1 (electricity only)_total	#N/A	30%	0%	52%		412.61	-0.25	2031	507.91	105.12	27.79
mid -f recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to grid injection	mid -f	Incineration 1 (electricity only)_total	#N/A	30%	0%	52%		412.61	-0.25	2031	507.33	105.12	27.64
mid -f recycling, True Pyrolysis 1_total	Wet AD with electricity generation	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		412.92	-0.29	2031	535.43	105.12	34.99
NC recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to transport fuel	NC	Incineration 1 (electricity only)_total	#N/A	30%	0%	62%		413.01	-0.11	-	464.16	83.05	38.41
NC recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to grid injection	NC	Incineration 1 (electricity only)_total	#N/A	30%	0%	62%		413.01	-0.11	-	464.00	83.05	38.37
hi recycling, Gasification Gas Engine 2_total	Wet AD with electricity generation	hi	Gasification Gas Engine 2_total	#N/A	32%	0%	47%		414.91	-0.33	2031	552.46	119.76	24.80
mid -d recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		415.19	-0.30	2031	465.69	96.27	25.58
mid -d recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to grid injection	mid -d	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		415.19	-0.30	2031	465.37	96.27	25.50
hi recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with electricity generation	hi	MBT aerobic 1	power_station_generic	36%	0%	-	33%	415.22	-0.42	2031	594.56	119.76	35.82
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	415.70	-0.30	2031	562.81	105.12	42.15
lo recycling, MBT aerobic 3, SRF to Gasification 1	Dry AD with electricity generation	lo	MBT aerobic 3	ATT_generic	30%	0%	-	43%	415.86	-0.30	2031	578.19	109.48	41.81
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	415.95	-0.30	2031	571.00	105.12	44.30
lo recycling, Incineration 2 (low CHP)_total	Dry AD with electricity generation	lo	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		416.01	-0.27	2031	581.08	109.48	42.57
hi recycling, True Pyrolysis 1_total	Wet AD with electricity generation	hi	True Pyrolysis 1_total	#N/A	32%	0%	47%		417.10	-0.32	2031	572.53	119.76	30.05
mid -f recycling, Gasification Gas Engine 2_total	Dry AD with electricity generation	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		417.22	-0.28	2031	511.53	105.12	28.73
mid -d recycling, Gasification Gas Engine 1_total	Dry AD with electricity generation	mid -d	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		417.39	-0.32	2031	483.48	96.27	30.24

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT aerobic 1, SRF to power_station_generic	38%	50%
NC recycling, Incineration 2 (low CHP)_total	46%	62%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
mid -d recycling, Gasification Gas Engine 1_total	74%	57%
mid -f recycling, Incineration 1 (electricity only)_total	73%	52%
mid -f recycling, Incineration 1 (electricity only)_total	73%	52%
mid -f recycling, True Pyrolysis 1_total	73%	52%
NC recycling, Incineration 1 (electricity only)_total	46%	62%
NC recycling, Incineration 1 (electricity only)_total	46%	62%
hi recycling, Gasification Gas Engine 2_total	80%	47%
mid -d recycling, Incineration 1 (electricity only)_total	74%	57%
mid -d recycling, Incineration 1 (electricity only)_total	74%	57%
hi recycling, MBT aerobic 1, SRF to power_station_generic	78%	33%
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	51%
lo recycling, MBT aerobic 3, SRF to Gasification 1	71%	43%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
lo recycling, Incineration 2 (low CHP)_total	74%	57%
hi recycling, True Pyrolysis 1_total	80%	47%
mid -f recycling, Gasification Gas Engine 2_total	73%	52%
mid -d recycling, Gasification Gas Engine 1_total	74%	57%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MBT aerobic 3	power_station_generic	36%	0%	-	40%	417.46	-0.40	2031	519.08	96.27	39.55
hi recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to transport fuel	hi	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	47%		418.51	-0.26	2031	579.59	119.76	31.90
hi recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to grid injection	hi	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	47%		418.51	-0.26	2031	578.65	119.76	31.66
mid -f recycling, Incineration 3 (medium CHP)_total	Aerobic Digestion	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		418.53	-0.29	2031	565.40	105.12	42.83
lo recycling, Gasification Gas Engine 2_total	Aerobic Digestion	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		418.86	-0.29	2031	526.75	109.48	28.35
mid -f recycling, True Pyrolysis 1_total	Dry AD with electricity generation	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		419.91	-0.27	2031	539.24	105.12	35.99
lo recycling, True Pyrolysis 1_total	Aerobic Digestion	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		422.12	-0.28	2031	553.34	109.48	35.31
mid -d recycling, Gasification Gas Engine 2_total	Aerobic Digestion	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		422.28	-0.33	2031	469.79	96.27	26.66
NC recycling, MBT aerobic 1, SRF to power_station_generic	Aerobic Digestion	NC	MBT aerobic 1	power_station_generic	36%	0%	-	50%	422.87	-0.31	2031	588.53	83.05	70.95
lo recycling, MBT aerobic 3, SRF to power_station_generic	Aerobic Digestion	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	423.00	-0.41	2031	578.16	109.48	41.80
mid -d recycling, Gasification 1_total	Wet AD with electricity generation	mid -d	Gasification 1_total	#N/A	30%	0%	57%		423.79	-0.33	2031	406.13	96.27	10.00
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Aerobic Digestion	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	423.94	-0.36	2031	507.02	96.27	36.40
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Aerobic Digestion	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	424.25	-0.36	2031	597.85	105.12	51.32
mid -d recycling, True Pyrolysis 1_total	Aerobic Digestion	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		425.55	-0.32	2031	496.56	96.27	33.66
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	Dirty MRF 1	incineration_generic	30%	0%	-	61%	426.49	-0.36	2031	504.93	96.27	35.85
NC recycling, Incineration 1 (electricity only)_total	Wet AD with electricity generation	NC	Incineration 1 (electricity only)_total	#N/A	30%	0%	62%		426.58	-0.12	-	462.63	83.05	38.01
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	426.71	-0.35	2031	543.92	105.12	37.21
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	426.91	-0.34	2031	601.46	119.76	37.62
hi recycling, Gasification Gas Engine 2_total	Dry AD with electricity generation	hi	Gasification Gas Engine 2_total	#N/A	32%	0%	47%		427.43	-0.30	2031	558.59	119.76	26.41
lo recycling, Incineration 1 (electricity only)_total	Wet AD with electricity generation	lo	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		427.56	-0.29	2031	517.33	109.48	25.89

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	69%	40%
hi recycling, Incineration 5 (medium efficiency electricity)_total	80%	47%
hi recycling, Incineration 5 (medium efficiency electricity)_total	80%	47%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
lo recycling, Gasification Gas Engine 2_total	74%	57%
mid -f recycling, True Pyrolysis 1_total	73%	52%
lo recycling, True Pyrolysis 1_total	74%	57%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
NC recycling, MBT aerobic 1, SRF to power_station_generic	38%	50%
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%
mid -d recycling, Gasification 1_total	74%	57%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
mid -d recycling, True Pyrolysis 1_total	74%	57%
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	61%
NC recycling, Incineration 1 (electricity only)_total	46%	62%
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	58%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
hi recycling, Gasification Gas Engine 2_total	80%	47%
lo recycling, Incineration 1 (electricity only)_total	74%	57%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, Incineration 1 (electricity only)_total	Dry AD with electricity generation	NC	Incineration 1 (electricity only)_total	#N/A	30%	0%	62%		427.90	-0.11	-	463.73	83.05	38.30
mid -f recycling, MHT 1, SRF to Gasification 1	Aerobic Digestion	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	428.83	-0.32	2031	595.55	105.12	50.72
mid -d recycling, Gasification 1_total	Dry AD with electricity generation	mid -d	Gasification 1_total	#N/A	30%	0%	57%		428.85	-0.32	2031	408.23	96.27	10.55
hi recycling, True Pyrolysis 1_total	Dry AD with electricity generation	hi	True Pyrolysis 1_total	#N/A	32%	0%	47%		429.75	-0.29	2031	578.67	119.76	31.66
hi recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	hi	MHT 2	ATT_generic	30%	0%	-	55%	430.65	-0.35	2031	618.27	119.76	42.02
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	Dirty MRF 1	incineration_generic	30%	0%	-	61%	431.88	-0.35	2031	507.03	96.27	36.40
NC recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with electricity generation	NC	MBT aerobic 3	ATT_generic	30%	0%	-	50%	431.99	-0.16	2015	587.44	83.05	70.67
mid -f recycling, Gasification Gas Engine 1_total	Wet AD with electricity generation	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		432.13	-0.29	2031	521.88	105.12	31.44
hi recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	hi	MBT aerobic 1	power_station_generic	36%	0%	-	33%	432.77	-0.39	2031	600.70	119.76	37.43
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MHT 1	incineration_generic	30%	0%	-	64%	432.94	-0.33	2031	607.11	109.48	49.38
hi recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	433.46	-0.41	2031	625.51	119.76	43.92
NC recycling, MBT aerobic 3, SRF to Gasification 1	Dry AD with electricity generation	NC	MBT aerobic 3	ATT_generic	30%	0%	-	50%	434.16	-0.15	2015	588.54	83.05	70.96
hi recycling, Gasification Gas Engine 1_total	Wet AD with electricity generation	hi	Gasification Gas Engine 1_total	#N/A	30%	0%	47%		434.53	-0.32	2031	562.71	119.76	27.49
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	434.74	-0.35	2031	560.21	109.48	37.11
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	434.97	-0.33	2031	547.73	105.12	38.21
NC recycling, Incineration 1 (electricity only)_total	Aerobic Digestion	NC	Incineration 1 (electricity only)_total	#N/A	30%	0%	62%		435.76	-0.11	-	463.72	83.05	38.30
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	436.04	-0.34	2031	516.20	96.27	38.80
lo recycling, Incineration 1 (electricity only)_total	Dry AD with electricity generation	lo	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		436.93	-0.27	2031	521.88	109.48	27.08
hi recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with electricity generation	hi	MBT aerobic 3	ATT_generic	30%	0%	-	33%	437.44	-0.34	2031	594.56	119.76	35.82
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	Dirty MRF 1	incineration_generic	30%	0%	-	52%	437.73	-0.37	2031	578.08	119.76	31.51

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, Incineration 1 (electricity only)_total	46%	62%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
mid -d recycling, Gasification 1_total	74%	57%
hi recycling, True Pyrolysis 1_total	80%	47%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	61%
NC recycling, MBT aerobic 3, SRF to Gasification 1	39%	50%
mid -f recycling, Gasification Gas Engine 1_total	73%	52%
hi recycling, MBT aerobic 1, SRF to power_station_generic	78%	33%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
NC recycling, MBT aerobic 3, SRF to Gasification 1	39%	50%
hi recycling, Gasification Gas Engine 1_total	80%	47%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	58%
NC recycling, Incineration 1 (electricity only)_total	46%	62%
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%
lo recycling, Incineration 1 (electricity only)_total	74%	57%
hi recycling, MBT aerobic 3, SRF to Gasification 1	78%	33%
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	82%	52%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, Gasification Gas Engine 1_total	Dry AD with electricity generation	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		439.41	-0.27	2031	525.69	105.12	32.44
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 1	incineration_generic	30%	0%	-	38%	440.31	-0.26	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT aerobic 1	incineration_generic	30%	0%	-	38%	440.31	-0.26	2031	567.18	105.12	43.30
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	441.95	-0.39	2031	562.45	105.12	42.06
mid -d recycling, Incineration 2 (low CHP)_total	Wet AD with electricity generation	mid -d	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		442.94	-0.32	2031	522.36	96.27	40.41
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT aerobic 3	incineration_generic	30%	0%	-	43%	443.17	-0.32	2031	573.64	109.48	40.62
mid -f recycling, Gasification 1_total	Wet AD with electricity generation	mid -f	Gasification 1_total	#N/A	30%	0%	52%		443.48	-0.29	2031	443.97	105.12	11.06
lo recycling, Gasification Gas Engine 1_total	Aerobic Digestion	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		444.22	-0.29	2031	540.34	109.48	31.91
hi recycling, Gasification 1_total	Wet AD with electricity generation	hi	Gasification 1_total	#N/A	30%	0%	47%		444.65	-0.32	2031	506.28	119.76	12.72
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 1	ATT_generic	30%	0%	-	40%	445.02	-0.31	2031	519.91	96.27	39.77
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MBT aerobic 1	ATT_generic	30%	0%	-	40%	445.02	-0.31	2031	519.59	96.27	39.69
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	445.47	-0.31	2031	575.20	109.48	41.03
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Aerobic Digestion	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	446.99	-0.34	2031	547.70	105.12	38.20
NC recycling, MBT aerobic 3, SRF to Gasification 1	Aerobic Digestion	NC	MBT aerobic 3	ATT_generic	30%	0%	-	50%	447.63	-0.15	2015	588.53	83.05	70.95
hi recycling, Gasification Gas Engine 1_total	Dry AD with electricity generation	hi	Gasification Gas Engine 1_total	#N/A	30%	0%	47%		447.65	-0.29	2031	568.85	119.76	29.09
mid -d recycling, Incineration 2 (low CHP)_total	Dry AD with electricity generation	mid -d	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		447.68	-0.31	2031	524.46	96.27	40.96
mid -d recycling, Gasification Gas Engine 1_total	Aerobic Digestion	mid -d	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		447.85	-0.32	2031	483.46	96.27	30.24
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 3	incineration_generic	30%	0%	-	40%	448.18	-0.30	2031	519.91	96.27	39.77
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT aerobic 3	incineration_generic	30%	0%	-	40%	448.18	-0.30	2031	519.59	96.27	39.69
lo recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with electricity generation	lo	MBT aerobic 1	ATT_generic	30%	0%	-	43%	448.58	-0.32	2031	573.64	109.48	40.62

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, Gasification Gas Engine 1_total	73%	52%
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	38%
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	38%
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	68%	38%
mid -d recycling, Incineration 2 (low CHP)_total	74%	57%
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	71%	43%
mid -f recycling, Gasification 1_total	73%	52%
lo recycling, Gasification Gas Engine 1_total	74%	57%
hi recycling, Gasification 1_total	80%	47%
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	69%	40%
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	69%	40%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
NC recycling, MBT aerobic 3, SRF to Gasification 1	39%	50%
hi recycling, Gasification Gas Engine 1_total	80%	47%
mid -d recycling, Incineration 2 (low CHP)_total	74%	57%
mid -d recycling, Gasification Gas Engine 1_total	74%	57%
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	40%
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	40%
lo recycling, MBT aerobic 1, SRF to Gasification 1	71%	43%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, Gasification 1_total	Dry AD with electricity generation	mid -f	Gasification 1_total	#N/A	30%	0%	52%		450.95	-0.27	2031	447.78	105.12	12.05
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MBT aerobic 3	incineration_generic	30%	0%	-	50%	451.85	-0.14	2015	588.97	83.05	71.07
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MBT aerobic 3	incineration_generic	30%	0%	-	50%	451.85	-0.14	2015	588.80	83.05	71.02
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	Dirty MRF 1	incineration_generic	30%	0%	-	52%	452.33	-0.34	2031	584.22	119.76	33.11
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	452.39	-0.37	2031	566.26	105.12	43.06
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Aerobic Digestion	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	454.20	-0.37	2031	553.39	96.27	48.53
hi recycling, MBT aerobic 3, SRF to Gasification 1	Dry AD with electricity generation	hi	MBT aerobic 3	ATT_generic	30%	0%	-	33%	455.84	-0.31	2031	600.70	119.76	37.43
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT aerobic 3	incineration_generic	30%	0%	-	43%	456.79	-0.29	2031	578.19	109.48	41.81
lo recycling, Gasification 1_total	Aerobic Digestion	lo	Gasification 1_total	#N/A	30%	0%	57%		457.54	-0.28	2031	465.59	109.48	12.35
hi recycling, Gasification 1_total	Dry AD with electricity generation	hi	Gasification 1_total	#N/A	30%	0%	47%		458.07	-0.29	2031	512.42	119.76	14.32
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MBT aerobic 1	power_station_generic	36%	0%	-	40%	460.75	-0.39	2031	516.98	96.27	39.00
mid -d recycling, Gasification 1_total	Aerobic Digestion	mid -d	Gasification 1_total	#N/A	30%	0%	57%		461.28	-0.32	2031	408.22	96.27	10.55
mid -f recycling, Gasification Gas Engine 2_total	Aerobic Digestion	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		461.54	-0.28	2031	511.50	105.12	28.73
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	Aerobic Digestion	mid -d	MBT aerobic 3	power_station_generic	36%	0%	-	40%	461.99	-0.40	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Aerobic Digestion	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	462.69	-0.40	2031	566.24	105.12	43.05
lo recycling, MBT aerobic 1, SRF to Gasification 1	Dry AD with electricity generation	lo	MBT aerobic 1	ATT_generic	30%	0%	-	43%	463.92	-0.29	2031	578.19	109.48	41.81
mid -f recycling, Incineration 2 (low CHP)_total	Wet AD with electricity generation	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		464.59	-0.28	2031	564.32	105.12	42.55
mid -f recycling, True Pyrolysis 1_total	Aerobic Digestion	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		465.12	-0.27	2031	539.22	105.12	35.98
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MBT aerobic 3	ATT_generic	30%	0%	-	38%	465.20	-0.30	2031	562.45	105.12	42.06
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	465.72	-0.35	2031	597.85	105.12	51.32

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, Gasification 1_total	73%	52%
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	39%	50%
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	39%	50%
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	82%	52%
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	68%	38%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
hi recycling, MBT aerobic 3, SRF to Gasification 1	78%	33%
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	71%	43%
lo recycling, Gasification 1_total	74%	57%
hi recycling, Gasification 1_total	80%	47%
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	69%	40%
mid -d recycling, Gasification 1_total	74%	57%
mid -f recycling, Gasification Gas Engine 2_total	73%	52%
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	69%	40%
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%
lo recycling, MBT aerobic 1, SRF to Gasification 1	71%	43%
mid -f recycling, Incineration 2 (low CHP)_total	73%	52%
mid -f recycling, True Pyrolysis 1_total	73%	52%
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	69%	38%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MBT aerobic 1	ATT_generic	30%	0%	-	50%	466.61	-0.14	2015	588.97	83.05	71.07
NC recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MBT aerobic 1	ATT_generic	30%	0%	-	50%	466.61	-0.14	2015	588.80	83.05	71.02
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	Dirty MRF 1	incineration_generic	30%	0%	-	61%	466.94	-0.35	2031	507.02	96.27	36.40
mid -d recycling, Incineration 1 (electricity only)_total	Wet AD with electricity generation	mid -d	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		467.15	-0.31	2031	462.76	96.27	24.82
hi recycling, Incineration 2 (low CHP)_total	Wet AD with electricity generation	hi	Incineration 2 (low CHP)_total	#N/A	22%	10%	47%		468.45	-0.31	2031	593.46	119.76	35.53
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MBT aerobic 1	power_station_generic	36%	0%	-	40%	468.54	-0.38	2031	519.08	96.27	39.55
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	470.01	-0.33	2031	601.46	119.76	37.62
hi recycling, Incineration 3 (medium CHP)_total	Aerobic Digestion	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		471.15	-0.31	2031	597.60	119.76	36.61
mid -f recycling, Incineration 2 (low CHP)_total	Dry AD with electricity generation	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		471.61	-0.26	2031	568.13	105.12	43.55
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	471.66	-0.31	2031	595.55	105.12	50.72
mid -d recycling, Incineration 1 (electricity only)_total	Dry AD with electricity generation	mid -d	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		472.15	-0.30	2031	464.86	96.27	25.37
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MHT 2	incineration_generic	30%	0%	-	55%	472.63	-0.35	2031	618.27	119.76	42.02
lo recycling, Incineration 2 (low CHP)_total	Aerobic Digestion	lo	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		475.30	-0.27	2031	581.05	109.48	42.56
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MBT aerobic 3	ATT_generic	30%	0%	-	38%	476.14	-0.28	2031	566.26	105.12	43.06
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MBT aerobic 3	incineration_generic	30%	0%	-	50%	476.19	-0.14	2015	587.44	83.05	70.67
hi recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with electricity generation	hi	MBT aerobic 1	ATT_generic	30%	0%	-	33%	477.02	-0.33	2031	594.56	119.76	35.82
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MBT aerobic 3	incineration_generic	30%	0%	-	50%	478.34	-0.14	2015	588.54	83.05	70.96
mid -f recycling, Gasification 2_total	Wet AD with biogas to transport fuel	mid -f	Gasification 2_total	#N/A	21%	0%	52%		479.12	-0.23569	2020	546.10	105.12	37.78
mid -f recycling, Gasification 2_total	Wet AD with biogas to grid injection	mid -f	Gasification 2_total	#N/A	21%	0%	52%		479.12	-0.23568	2020	545.51	105.12	37.63
mid -d recycling, Incineration 2 (low CHP)_total	Aerobic Digestion	mid -d	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		479.53	-0.31	2031	524.45	96.27	40.96

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT aerobic 1, SRF to Gasification 1	39%	50%
NC recycling, MBT aerobic 1, SRF to Gasification 1	39%	50%
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	61%
mid -d recycling, Incineration 1 (electricity only)_total	74%	57%
hi recycling, Incineration 2 (low CHP)_total	80%	47%
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	69%	40%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%
mid -f recycling, Incineration 2 (low CHP)_total	73%	52%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
mid -d recycling, Incineration 1 (electricity only)_total	74%	57%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
lo recycling, Incineration 2 (low CHP)_total	74%	57%
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	69%	38%
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	39%	50%
hi recycling, MBT aerobic 1, SRF to Gasification 1	78%	33%
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	39%	50%
mid -f recycling, Gasification 2_total	73%	52%
mid -f recycling, Gasification 2_total	73%	52%
mid -d recycling, Incineration 2 (low CHP)_total	74%	57%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	480.19	-0.30	2031	562.78	105.12	42.15
hi recycling, Incineration 2 (low CHP)_total	Dry AD with electricity generation	hi	Incineration 2 (low CHP)_total	#N/A	22%	10%	47%		481.16	-0.28	2031	599.60	119.76	37.14
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT aerobic 3	incineration_generic	30%	0%	-	33%	482.22	-0.33	2031	594.56	119.76	35.82
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	52%		487.38	-0.23	2020	538.68	105.12	35.84
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to grid injection	mid -f	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	52%		487.38	-0.23	2020	538.10	105.12	35.69
lo recycling, MBT aerobic 1, SRF to power_station_generic	Aerobic Digestion	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	488.69	-0.38	2031	578.16	109.48	41.80
mid -f recycling, Incineration 1 (electricity only)_total	Wet AD with electricity generation	mid -f	Incineration 1 (electricity only)_total	#N/A	30%	0%	52%		488.88	-0.27	2031	502.60	105.12	26.40
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MBT aerobic 3	ATT_generic	30%	0%	-	40%	489.28	-0.32	2031	516.98	96.27	39.00
mid -f recycling, Gasification Gas Engine 1_total	Aerobic Digestion	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		489.49	-0.27	2031	525.67	105.12	32.43
hi recycling, Incineration 1 (electricity only)_total	Wet AD with electricity generation	hi	Incineration 1 (electricity only)_total	#N/A	30%	0%	47%		490.19	-0.30	2031	548.75	119.76	23.83
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 1	incineration_generic	30%	0%	-	40%	491.70	-0.30	2031	519.91	96.27	39.77
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT aerobic 1	incineration_generic	30%	0%	-	40%	491.70	-0.30	2031	519.59	96.27	39.69
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	492.11	-0.33	2031	547.70	105.12	38.20
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MBT aerobic 3	incineration_generic	30%	0%	-	50%	493.29	-0.14	2015	588.53	83.05	70.95
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT aerobic 1	incineration_generic	30%	0%	-	43%	494.54	-0.31	2031	573.64	109.48	40.62
NC recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with electricity generation	NC	MBT aerobic 1	ATT_generic	30%	0%	-	50%	495.79	-0.14	2015	587.44	83.05	70.67
mid -f recycling, Incineration 1 (electricity only)_total	Dry AD with electricity generation	mid -f	Incineration 1 (electricity only)_total	#N/A	30%	0%	52%		496.27	-0.25	2031	506.42	105.12	27.40
mid -d recycling, Gasification 2_total	Wet AD with biogas to transport fuel	mid -d	Gasification 2_total	#N/A	21%	0%	57%		496.63	-0.29	2031	502.57	96.27	35.23
mid -d recycling, Gasification 2_total	Wet AD with biogas to grid injection	mid -d	Gasification 2_total	#N/A	21%	0%	57%		496.63	-0.29	2031	502.25	96.27	35.15
hi recycling, MHT 1, SRF to Gasification 1	Aerobic Digestion	hi	MHT 1	ATT_generic	30%	0%	-	55%	496.94	-0.35	2031	618.27	119.76	42.02

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	51%
hi recycling, Incineration 2 (low CHP)_total	80%	47%
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	78%	33%
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	73%	52%
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	73%	52%
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
mid -f recycling, Incineration 1 (electricity only)_total	73%	52%
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	69%	40%
mid -f recycling, Gasification Gas Engine 1_total	73%	52%
hi recycling, Incineration 1 (electricity only)_total	80%	47%
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	40%
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	58%
NC recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	39%	50%
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	71%	43%
NC recycling, MBT aerobic 1, SRF to Gasification 1	39%	50%
mid -f recycling, Incineration 1 (electricity only)_total	73%	52%
mid -d recycling, Gasification 2_total	74%	57%
mid -d recycling, Gasification 2_total	74%	57%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT aerobic 1, SRF to Gasification 1	Dry AD with electricity generation	hi	MBT aerobic 1	ATT_generic	30%	0%	-	33%	497.10	-0.30	2031	600.70	119.76	37.43
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MBT aerobic 3	ATT_generic	30%	0%	-	40%	497.51	-0.31	2031	519.08	96.27	39.55
NC recycling, MBT aerobic 1, SRF to Gasification 1	Dry AD with electricity generation	NC	MBT aerobic 1	ATT_generic	30%	0%	-	50%	498.29	-0.14	2015	588.54	83.05	70.96
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	499.29	-0.37	2031	553.39	96.27	48.53
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		499.56	-0.28	2031	495.40	96.27	33.36
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to grid injection	mid -d	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		499.56	-0.28	2031	495.08	96.27	33.28
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT aerobic 3	incineration_generic	30%	0%	-	33%	500.48	-0.30	2031	600.70	119.76	37.43
hi recycling, Incineration 1 (electricity only)_total	Dry AD with electricity generation	hi	Incineration 1 (electricity only)_total	#N/A	30%	0%	47%		503.48	-0.28	2031	554.89	119.76	25.44
lo recycling, Incineration 1 (electricity only)_total	Aerobic Digestion	lo	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		503.64	-0.27	2031	521.85	109.48	27.07
mid -f recycling, Gasification 1_total	Aerobic Digestion	mid -f	Gasification 1_total	#N/A	30%	0%	52%		504.17	-0.27	2031	447.76	105.12	12.05
mid -d recycling, Incineration 1 (electricity only)_total	Aerobic Digestion	mid -d	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		508.12	-0.30	2031	464.85	96.27	25.36
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT aerobic 1	incineration_generic	30%	0%	-	43%	509.74	-0.28	2031	578.19	109.48	41.81
hi recycling, MBT aerobic 3, SRF to power_station_generic	Aerobic Digestion	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	510.54	-0.41	2031	600.66	119.76	37.42
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MBT aerobic 3	incineration_generic	30%	0%	-	38%	512.89	-0.29	2031	562.45	105.12	42.06
NC recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to transport fuel	NC	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	62%		513.90	-0.07	-	525.21	83.05	54.38
NC recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with biogas to grid injection	NC	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	62%		513.90	-0.07	-	525.04	83.05	54.34
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MBT aerobic 1	incineration_generic	30%	0%	-	50%	514.74	-0.12	-	588.97	83.05	71.07
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MBT aerobic 1	incineration_generic	30%	0%	-	50%	514.74	-0.12	-	588.80	83.05	71.02
NC recycling, MBT aerobic 1, SRF to Gasification 1	Aerobic Digestion	NC	MBT aerobic 1	ATT_generic	30%	0%	-	50%	516.62	-0.14	2015	588.53	83.05	70.95
lo recycling, MBT aerobic 3, SRF to Gasification 1	Aerobic Digestion	lo	MBT aerobic 3	ATT_generic	30%	0%	-	43%	516.74	-0.30	2031	578.16	109.48	41.80

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT aerobic 1, SRF to Gasification 1	78%	33%
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	69%	40%
NC recycling, MBT aerobic 1, SRF to Gasification 1	39%	50%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	78%	33%
hi recycling, Incineration 1 (electricity only)_total	80%	47%
lo recycling, Incineration 1 (electricity only)_total	74%	57%
mid -f recycling, Gasification 1_total	73%	52%
mid -d recycling, Incineration 1 (electricity only)_total	74%	57%
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	71%	43%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	38%
NC recycling, Incineration 5 (medium efficiency electricity)_total	46%	62%
NC recycling, Incineration 5 (medium efficiency electricity)_total	46%	62%
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	39%	50%
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	39%	50%
NC recycling, MBT aerobic 1, SRF to Gasification 1	39%	50%
lo recycling, MBT aerobic 3, SRF to Gasification 1	71%	43%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, Gasification 2_total	Wet AD with electricity generation	lo	Gasification 2_total	#N/A	21%	0%	57%		518.15	-0.27	2031	553.96	109.48	35.47
lo recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with electricity generation	lo	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		518.20	-0.27	2031	546.85	109.48	33.61
hi recycling, Gasification Gas Engine 2_total	Aerobic Digestion	hi	Gasification Gas Engine 2_total	#N/A	32%	0%	47%		519.98	-0.30	2031	558.55	119.76	26.40
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	520.31	-0.29	2031	562.45	105.12	42.06
hi recycling, Dirty MRF 1, SRF to Gasification 1	Aerobic Digestion	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	521.11	-0.35	2031	584.18	119.76	33.10
NC recycling, Gasification 2_total	Wet AD with biogas to transport fuel	NC	Gasification 2_total	#N/A	21%	0%	62%		521.93	-0.08	-	539.92	83.05	58.23
NC recycling, Gasification 2_total	Wet AD with biogas to grid injection	NC	Gasification 2_total	#N/A	21%	0%	62%		521.93	-0.08	-	539.75	83.05	58.19
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	523.49	-0.33	2031	596.74	119.76	36.39
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MBT aerobic 3	incineration_generic	30%	0%	-	38%	523.72	-0.27	2031	566.26	105.12	43.06
mid -f recycling, Incineration 2 (low CHP)_total	Aerobic Digestion	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		523.96	-0.26	2031	568.10	105.12	43.54
hi recycling, True Pyrolysis 1_total	Aerobic Digestion	hi	True Pyrolysis 1_total	#N/A	32%	0%	47%		524.04	-0.29	2031	578.63	119.76	31.65
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT aerobic 1	incineration_generic	30%	0%	-	33%	526.04	-0.32	2031	594.56	119.76	35.82
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	Aerobic Digestion	mid -d	MBT aerobic 1	power_station_generic	36%	0%	-	40%	526.95	-0.38	2031	519.07	96.27	39.55
hi recycling, MBT aerobic 4, SRF to Gasification 1	Aerobic Digestion	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	529.39	-0.37	2031	625.51	119.76	43.92
lo recycling, Incineration 5 (medium efficiency electricity)_total	Dry AD with electricity generation	lo	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		529.56	-0.24	2031	551.40	109.48	34.80
lo recycling, Gasification 2_total	Dry AD with electricity generation	lo	Gasification 2_total	#N/A	21%	0%	57%		530.80	-0.25	2031	558.51	109.48	36.66
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	Aerobic Digestion	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	531.55	-0.37	2031	566.24	105.12	43.05
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	532.54	-0.27	2031	566.26	105.12	43.06
NC recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with electricity generation	NC	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	62%		535.09	-0.07	-	523.68	83.05	53.98
NC recycling, Incineration 5 (medium efficiency electricity)_total	Dry AD with electricity generation	NC	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	62%		536.74	-0.07	-	524.78	83.05	54.27

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, Gasification 2_total	74%	57%
lo recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
hi recycling, Gasification Gas Engine 2_total	80%	47%
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	69%	38%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
NC recycling, Gasification 2_total	46%	62%
NC recycling, Gasification 2_total	46%	62%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	38%
mid -f recycling, Incineration 2 (low CHP)_total	73%	52%
hi recycling, True Pyrolysis 1_total	80%	47%
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	78%	33%
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	69%	40%
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%
lo recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
lo recycling, Gasification 2_total	74%	57%
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	68%	38%
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	69%	38%
NC recycling, Incineration 5 (medium efficiency electricity)_total	46%	62%
NC recycling, Incineration 5 (medium efficiency electricity)_total	46%	62%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT aerobic 3	incineration_generic	30%	0%	-	40%	539.45	-0.31	2031	516.98	96.27	39.00
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MHT 1	incineration_generic	30%	0%	-	55%	545.38	-0.34	2031	618.27	119.76	42.02
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT aerobic 1	incineration_generic	30%	0%	-	33%	545.95	-0.29	2031	600.70	119.76	37.43
NC recycling, Gasification 2_total	Wet AD with electricity generation	NC	Gasification 2_total	#N/A	21%	0%	62%		546.44	-0.08	-	538.39	83.05	57.83
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MBT aerobic 1	incineration_generic	30%	0%	-	50%	546.55	-0.12	-	587.44	83.05	70.67
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MBT aerobic 1	ATT_generic	30%	0%	-	40%	547.52	-0.32	2031	516.98	96.27	39.00
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT aerobic 3	incineration_generic	30%	0%	-	40%	547.59	-0.30	2031	519.08	96.27	39.55
NC recycling, Gasification 2_total	Dry AD with electricity generation	NC	Gasification 2_total	#N/A	21%	0%	62%		548.32	-0.08	-	539.49	83.05	58.12
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MBT aerobic 1	incineration_generic	30%	0%	-	50%	549.03	-0.12	-	588.54	83.05	70.96
NC recycling, Incineration 5 (medium efficiency electricity)_total	Aerobic Digestion	NC	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	62%		549.73	-0.07	-	524.77	83.05	54.27
hi recycling, Gasification Gas Engine 1_total	Aerobic Digestion	hi	Gasification Gas Engine 1_total	#N/A	30%	0%	47%		551.47	-0.29	2031	568.81	119.76	29.08
mid -f recycling, Incineration 1 (electricity only)_total	Aerobic Digestion	mid -f	Incineration 1 (electricity only)_total	#N/A	30%	0%	52%		555.21	-0.25	2031	506.39	105.12	27.39
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MBT aerobic 1	ATT_generic	30%	0%	-	40%	556.72	-0.31	2031	519.08	96.27	39.55
NC recycling, Gasification 2_total	Aerobic Digestion	NC	Gasification 2_total	#N/A	21%	0%	62%		563.56	-0.08	-	539.48	83.05	58.12
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	Aerobic Digestion	mid -d	MBT aerobic 3	ATT_generic	30%	0%	-	40%	564.39	-0.31	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	Aerobic Digestion	mid -f	MBT aerobic 3	ATT_generic	30%	0%	-	38%	565.24	-0.28	2031	566.24	105.12	43.05
hi recycling, Gasification 1_total	Aerobic Digestion	hi	Gasification 1_total	#N/A	30%	0%	47%		568.01	-0.29	2031	512.38	119.76	14.31
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MBT aerobic 3	incineration_generic	30%	0%	-	43%	568.47	-0.29	2031	578.16	109.48	41.80
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MBT aerobic 1	incineration_generic	30%	0%	-	50%	569.31	-0.12	-	588.53	83.05	70.95
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	Dirty MRF 1	incineration_generic	30%	0%	-	52%	573.17	-0.34	2031	584.18	119.76	33.10

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	40%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	78%	33%
NC recycling, Gasification 2_total	46%	62%
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	39%	50%
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	69%	40%
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	40%
NC recycling, Gasification 2_total	46%	62%
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	39%	50%
NC recycling, Incineration 5 (medium efficiency electricity)_total	46%	62%
hi recycling, Gasification Gas Engine 1_total	80%	47%
mid -f recycling, Incineration 1 (electricity only)_total	73%	52%
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	69%	40%
NC recycling, Gasification 2_total	46%	62%
mid -d recycling, MBT aerobic 3, SRF to Gasification 1	69%	40%
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	69%	38%
hi recycling, Gasification 1_total	80%	47%
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	71%	43%
NC recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	39%	50%
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	82%	52%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MBT aerobic 1	incineration_generic	30%	0%	-	38%	573.79	-0.28	2031	562.45	105.12	42.06
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with electricity generation	mid -d	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		576.74	-0.29	2031	492.48	96.27	32.59
hi recycling, Gasification 2_total	Wet AD with electricity generation	hi	Gasification 2_total	#N/A	21%	0%	47%		578.67	-0.29	2031	576.41	119.76	31.07
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	579.23	-0.37	2031	625.51	119.76	43.92
hi recycling, MBT aerobic 1, SRF to power_station_generic	Aerobic Digestion	hi	MBT aerobic 1	power_station_generic	36%	0%	-	33%	579.99	-0.39	2031	600.66	119.76	37.42
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	Dry AD with electricity generation	mid -d	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		582.92	-0.28	2031	494.58	96.27	33.14
mid -d recycling, Gasification 2_total	Wet AD with electricity generation	mid -d	Gasification 2_total	#N/A	21%	0%	57%		583.11	-0.30	2031	499.64	96.27	34.47
hi recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with electricity generation	hi	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	47%		584.50	-0.29	2031	571.04	119.76	29.66
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MBT aerobic 1	incineration_generic	30%	0%	-	38%	585.91	-0.26	2031	566.26	105.12	43.06
hi recycling, Incineration 2 (low CHP)_total	Aerobic Digestion	hi	Incineration 2 (low CHP)_total	#N/A	22%	10%	47%		589.85	-0.28	2031	599.56	119.76	37.13
mid -d recycling, Gasification 2_total	Dry AD with electricity generation	mid -d	Gasification 2_total	#N/A	21%	0%	57%		590.08	-0.29	2031	501.74	96.27	35.02
hi recycling, Gasification 2_total	Dry AD with electricity generation	hi	Gasification 2_total	#N/A	21%	0%	47%		596.14	-0.26	2031	582.55	119.76	32.68
lo recycling, MBT aerobic 1, SRF to Gasification 1	Aerobic Digestion	lo	MBT aerobic 1	ATT_generic	30%	0%	-	43%	596.98	-0.29	2031	578.16	109.48	41.80
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	Wet AD with electricity generation	mid -f	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	52%		597.49	-0.24	2031	533.37	105.12	34.45
mid -f recycling, Gasification 2_total	Wet AD with electricity generation	mid -f	Gasification 2_total	#N/A	21%	0%	52%		600.30	-0.25391	2031	540.79	105.12	36.39
hi recycling, Incineration 5 (medium efficiency electricity)_total	Dry AD with electricity generation	hi	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	47%		600.35	-0.26	2031	577.18	119.76	31.27
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT aerobic 1	incineration_generic	30%	0%	-	40%	603.78	-0.31	2031	516.98	96.27	39.00
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	Dry AD with electricity generation	mid -f	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	52%		606.52	-0.23	2020	537.18	105.12	35.45
mid -f recycling, Gasification 2_total	Dry AD with electricity generation	mid -f	Gasification 2_total	#N/A	21%	0%	52%		610.41	-0.23567	2020	544.60	105.12	37.39
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT aerobic 1	incineration_generic	30%	0%	-	40%	612.89	-0.30	2031	519.08	96.27	39.55

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	38%
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
hi recycling, Gasification 2_total	80%	47%
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
hi recycling, MBT aerobic 1, SRF to power_station_generic	78%	33%
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -d recycling, Gasification 2_total	74%	57%
hi recycling, Incineration 5 (medium efficiency electricity)_total	80%	47%
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	38%
hi recycling, Incineration 2 (low CHP)_total	80%	47%
mid -d recycling, Gasification 2_total	74%	57%
hi recycling, Gasification 2_total	80%	47%
lo recycling, MBT aerobic 1, SRF to Gasification 1	71%	43%
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	73%	52%
mid -f recycling, Gasification 2_total	73%	52%
hi recycling, Incineration 5 (medium efficiency electricity)_total	80%	47%
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	73%	52%
mid -f recycling, Gasification 2_total	73%	52%
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	40%

APPENDIX D – SCENARIO OUTPUTS – ALL SCENARIOS RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MBT aerobic 3	incineration_generic	30%	0%	-	40%	621.53	-0.30	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MBT aerobic 3	incineration_generic	30%	0%	-	38%	622.22	-0.27	2031	566.24	105.12	43.05
hi recycling, MBT aerobic 3, SRF to Gasification 1	Aerobic Digestion	hi	MBT aerobic 3	ATT_generic	30%	0%	-	33%	623.67	-0.31	2031	600.66	119.76	37.42
hi recycling, Incineration 1 (electricity only)_total	Aerobic Digestion	hi	Incineration 1 (electricity only)_total	#N/A	30%	0%	47%		625.02	-0.28	2031	554.85	119.76	25.43
lo recycling, Incineration 5 (medium efficiency electricity)_total	Aerobic Digestion	lo	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		635.37	-0.24	2031	551.37	109.48	34.79
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	Aerobic Digestion	mid -d	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	57%		641.02	-0.28	2031	494.57	96.27	33.14
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	Aerobic Digestion	mid -d	MBT aerobic 1	ATT_generic	30%	0%	-	40%	643.75	-0.31	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Aerobic Digestion	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	649.37	-0.27	2031	566.24	105.12	43.05
lo recycling, Gasification 2_total	Aerobic Digestion	lo	Gasification 2_total	#N/A	21%	0%	57%		652.15	-0.25	2031	558.48	109.48	36.66
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MBT aerobic 1	incineration_generic	30%	0%	-	43%	656.74	-0.28	2031	578.16	109.48	41.80
mid -d recycling, Gasification 2_total	Aerobic Digestion	mid -d	Gasification 2_total	#N/A	21%	0%	57%		657.47	-0.29	2031	501.73	96.27	35.01
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MBT aerobic 3	incineration_generic	30%	0%	-	33%	685.78	-0.30	2031	600.66	119.76	37.42
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	Aerobic Digestion	mid -f	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	52%		700.42	-0.23	2020	537.16	105.12	35.44
hi recycling, MBT aerobic 1, SRF to Gasification 1	Aerobic Digestion	hi	MBT aerobic 1	ATT_generic	30%	0%	-	33%	708.51	-0.30	2031	600.66	119.76	37.42
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MBT aerobic 1	incineration_generic	30%	0%	-	40%	708.92	-0.30	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -f	MBT aerobic 1	incineration_generic	30%	0%	-	38%	714.82	-0.26	2031	566.24	105.12	43.05
mid -f recycling, Gasification 2_total	Aerobic Digestion	mid -f	Gasification 2_total	#N/A	21%	0%	52%		718.60	-0.23566	2020	544.58	105.12	37.38
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	hi	MBT aerobic 1	incineration_generic	30%	0%	-	33%	779.07	-0.29	2031	600.66	119.76	37.42
hi recycling, Incineration 5 (medium efficiency electricity)_total	Aerobic Digestion	hi	Incineration 5 (medium efficiency electricity)_total	#N/A	24%	0%	47%		788.49	-0.26	2031	577.14	119.76	31.26
hi recycling, Gasification 2_total	Aerobic Digestion	hi	Gasification 2_total	#N/A	21%	0%	47%		809.59	-0.26	2031	582.51	119.76	32.67

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	69%	38%
hi recycling, MBT aerobic 3, SRF to Gasification 1	78%	33%
hi recycling, Incineration 1 (electricity only)_total	80%	47%
lo recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -d recycling, Incineration 5 (medium efficiency electricity)_total	74%	57%
mid -d recycling, MBT aerobic 1, SRF to Gasification 1	69%	40%
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	69%	38%
lo recycling, Gasification 2_total	74%	57%
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	71%	43%
mid -d recycling, Gasification 2_total	74%	57%
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	78%	33%
mid -f recycling, Incineration 5 (medium efficiency electricity)_total	73%	52%
hi recycling, MBT aerobic 1, SRF to Gasification 1	78%	33%
mid -d recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	40%
mid -f recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	69%	38%
mid -f recycling, Gasification 2_total	73%	52%
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	78%	33%
hi recycling, Incineration 5 (medium efficiency electricity)_total	80%	47%
hi recycling, Gasification 2_total	80%	47%

APPENDIX E – SCENARIO OUTPUTS – SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.29	2031	608.32	109.48	49.70
mid -f recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.28	2031	598.29	105.12	51.44
hi recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.32	2031	627.19	119.76	44.36
lo recycling, MBT biostab 1	Wet AD with biogas to transport fuel	lo	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.29	2031	605.31	109.48	48.91
mid -f recycling, MBT biostab 1	Wet AD with biogas to transport fuel	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.28	2031	595.76	105.12	50.78
hi recycling, MBT biostab 1	Wet AD with biogas to transport fuel	hi	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.32	2031	625.71	119.76	43.97
lo recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.29	2031	607.62	109.48	49.51
mid -f recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.28	2031	597.71	105.12	51.29
hi recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.32	2031	626.25	119.76	44.11
lo recycling, MBT biostab 1	Wet AD with biogas to grid injection	lo	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.29	2031	604.61	109.48	48.73
mid -f recycling, MBT biostab 1	Wet AD with biogas to grid injection	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.28	2031	595.18	105.12	50.62
hi recycling, MBT biostab 1	Wet AD with biogas to grid injection	hi	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.32	2031	624.77	119.76	43.72
mid -d recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.31	2031	544.60	96.27	46.23
mid -d recycling, MBT biostab 1	Wet AD with biogas to transport fuel	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.31	2031	541.72	96.27	45.48
mid -d recycling, MBT aerobic 2 (landfill)	Wet AD with biogas to grid injection	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	20.20	-0.31	2031	544.28	96.27	46.15
mid -d recycling, MBT biostab 1	Wet AD with biogas to grid injection	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	20.20	-0.31	2031	541.40	96.27	45.39
hi recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.35	2031	618.64	119.76	42.12
hi recycling, MBT biostab 1	Wet AD with electricity generation	hi	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.35	2031	617.16	119.76	41.73
lo recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.31	2031	601.99	109.48	48.04
mid -f recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.30	2031	592.98	105.12	50.05

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%
hi recycling, MBT aerobic 2 (landfill)	75%	0%
lo recycling, MBT biostab 1	67%	0%
mid -f recycling, MBT biostab 1	65%	0%
hi recycling, MBT biostab 1	75%	0%
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%
hi recycling, MBT aerobic 2 (landfill)	75%	0%
lo recycling, MBT biostab 1	67%	0%
mid -f recycling, MBT biostab 1	65%	0%
hi recycling, MBT biostab 1	75%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -d recycling, MBT biostab 1	66%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -d recycling, MBT biostab 1	66%	0%
hi recycling, MBT aerobic 2 (landfill)	75%	0%
hi recycling, MBT biostab 1	75%	0%
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT biostab 1	Wet AD with electricity generation	lo	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.31	2031	598.98	109.48	47.25
mid -f recycling, MBT biostab 1	Wet AD with electricity generation	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.30	2031	590.46	105.12	49.39
mid -d recycling, MBT aerobic 2 (landfill)	Wet AD with electricity generation	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	50.50	-0.32	2031	541.67	96.27	45.47
mid -d recycling, MBT biostab 1	Wet AD with electricity generation	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	50.50	-0.32	2031	538.79	96.27	44.71
mid -d recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	77.20	-0.46	2031	550.71	96.27	47.83
mid -d recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	77.20	-0.46	2031	550.39	96.27	47.75
lo recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	78.01	-0.42	2031	608.48	109.48	49.74
lo recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	78.01	-0.42	2031	607.78	109.48	49.56
NC recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MHT 2	cement_kiln	0%	100%	-	70%	80.36	-0.46	2031	642.63	83.05	85.11
NC recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MHT 2	cement_kiln	0%	100%	-	70%	80.36	-0.46	2031	642.46	83.05	85.07
NC recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	81.22	-0.38	2031	645.86	83.05	85.96
NC recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	81.22	-0.38	2031	645.69	83.05	85.91
NC recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	NC	MHT 2	cement_kiln	0%	100%	-	70%	81.57	-0.46	2031	641.10	83.05	84.71
NC recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	NC	MHT 2	cement_kiln	0%	100%	-	70%	82.17	-0.46	2031	642.20	83.05	85.00
NC recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	NC	MHT 2	cement_kiln	0%	100%	-	70%	82.22	-0.46	2031	642.19	83.05	85.00
mid -d recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	82.40	-0.47	2031	547.78	96.27	47.06
NC recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	83.65	-0.38	2031	644.33	83.05	85.55
lo recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MHT 2	cement_kiln	0%	100%	-	64%	84.06	-0.45	2031	608.92	109.48	49.85
lo recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MHT 2	cement_kiln	0%	100%	-	64%	84.06	-0.45	2031	608.23	109.48	49.67
NC recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	84.84	-0.38	2031	645.43	83.05	85.84

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT biostab 1	67%	0%
mid -f recycling, MBT biostab 1	65%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -d recycling, MBT biostab 1	66%	0%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
NC recycling, MHT 2, SRF to cement_kiln	41%	70%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	NC	MBT aerobic 4	cement_kiln	0%	100%	-	79%	85.01	-0.38	2031	645.42	83.05	85.84
mid -d recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	85.09	-0.46	2031	549.88	96.27	47.62
mid -d recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	mid -d	MHT 2	cement_kiln	0%	100%	-	70%	85.48	-0.46	2031	549.87	96.27	47.61
hi recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	88.55	-0.40	2031	627.96	119.76	44.56
hi recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	88.55	-0.40	2031	627.02	119.76	44.31
mid -d recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	90.53	-0.44	2031	550.71	96.27	47.83
mid -d recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	90.53	-0.44	2031	550.39	96.27	47.75
NC recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MHT 1	cement_kiln	0%	100%	-	70%	92.76	-0.42	2031	642.63	83.05	85.11
NC recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MHT 1	cement_kiln	0%	100%	-	70%	92.76	-0.42	2031	642.46	83.05	85.07
hi recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MHT 2	cement_kiln	0%	100%	-	55%	92.91	-0.43	2031	620.72	119.76	42.66
hi recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MHT 2	cement_kiln	0%	100%	-	55%	92.91	-0.43	2031	619.78	119.76	42.42
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	93.00	-0.48	2031	596.80	83.05	73.12
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	93.00	-0.48	2031	596.63	83.05	73.07
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	93.24	-0.40	2031	599.37	105.12	51.72
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	93.24	-0.40	2031	598.79	105.12	51.57
lo recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	lo	MHT 2	cement_kiln	0%	100%	-	64%	93.88	-0.48	2031	602.59	109.48	48.20
mid -f recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	93.92	-0.44	2031	597.07	105.12	51.12
mid -f recycling, MHT 2, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	93.92	-0.44	2031	596.48	105.12	50.97
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	94.15	-0.48	2031	595.27	83.05	72.72
NC recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	NC	MHT 1	cement_kiln	0%	100%	-	70%	94.37	-0.43	2031	641.10	83.05	84.71

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT aerobic 4, SRF to cement_kiln	41%	79%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
mid -d recycling, MHT 2, SRF to cement_kiln	71%	70%
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	94.65	-0.48	2031	596.37	83.05	73.00
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	NC	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	68%	94.80	-0.48	2031	596.36	83.05	73.00
lo recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MHT 1	cement_kiln	0%	100%	-	64%	94.98	-0.44	2031	608.92	109.48	49.85
lo recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MHT 1	cement_kiln	0%	100%	-	64%	94.98	-0.44	2031	608.23	109.48	49.67
NC recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	NC	MHT 1	cement_kiln	0%	100%	-	70%	95.06	-0.42	2031	642.20	83.05	85.00
NC recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	NC	MHT 1	cement_kiln	0%	100%	-	70%	95.27	-0.42	2031	642.19	83.05	85.00
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	95.46	-0.48	2031	527.31	96.27	41.71
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	95.46	-0.48	2031	526.99	96.27	41.62
lo recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	95.67	-0.44	2031	602.15	109.48	48.08
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	97.46	-0.46	2031	584.97	109.48	43.59
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	97.46	-0.46	2031	584.27	109.48	43.40
mid -d recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	97.77	-0.45	2031	547.78	96.27	47.06
lo recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	lo	MHT 2	cement_kiln	0%	100%	-	64%	98.55	-0.45	2031	607.14	109.48	49.39
lo recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	lo	MHT 2	cement_kiln	0%	100%	-	64%	100.37	-0.45	2031	607.11	109.48	49.38
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	100.44	-0.49	2031	524.39	96.27	40.94
mid -d recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	100.97	-0.44	2031	549.88	96.27	47.62
mid -d recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	mid -d	MHT 1	cement_kiln	0%	100%	-	70%	102.32	-0.44	2031	549.87	96.27	47.61
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	102.52	-0.48	2031	526.49	96.27	41.49
hi recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MHT 1	cement_kiln	0%	100%	-	55%	102.68	-0.41	2031	620.72	119.76	42.66
hi recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MHT 1	cement_kiln	0%	100%	-	55%	102.68	-0.41	2031	619.78	119.76	42.42

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
NC recycling, MBT AD 2 (SRF), SRF to cement_kiln	32%	68%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
NC recycling, MHT 1, SRF to cement_kiln	41%	70%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
lo recycling, MHT 2, SRF to cement_kiln	72%	64%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
mid -d recycling, MHT 1, SRF to cement_kiln	71%	70%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	103.06	-0.46	2031	591.76	105.12	49.73
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	mid -d	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	66%	103.44	-0.48	2031	526.48	96.27	41.49
lo recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	104.72	-0.42	2031	606.69	109.48	49.27
mid -f recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	106.76	-0.42	2031	597.07	105.12	51.12
mid -f recycling, MHT 1, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	106.76	-0.42	2031	596.48	105.12	50.97
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	106.84	-0.48	2031	578.64	109.48	41.93
mid -f recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	106.95	-0.44	2031	595.57	105.12	50.73
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	107.59	-0.40	2031	554.23	96.27	48.75
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	107.59	-0.40	2031	553.91	96.27	48.67
lo recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	lo	MHT 1	cement_kiln	0%	100%	-	64%	107.71	-0.46	2031	602.59	109.48	48.20
mid -f recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	mid -f	MHT 2	cement_kiln	0%	100%	-	61%	109.04	-0.44	2031	595.55	105.12	50.72
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	109.11	-0.46	2031	572.52	105.12	44.70
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	109.11	-0.46	2031	571.94	105.12	44.54
lo recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	lo	MBT aerobic 4	cement_kiln	0%	100%	-	73%	109.66	-0.42	2031	606.67	109.48	49.26
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	109.77	-0.44	2031	603.91	119.76	38.26
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	109.77	-0.44	2031	602.97	119.76	38.02
lo recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	lo	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.29	2031	606.53	109.48	49.23
mid -f recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	mid -f	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.28	2031	596.79	105.12	51.05
lo recycling, MBT biostab 1	Dry AD with electricity generation	lo	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.29	2031	603.52	109.48	48.44
mid -f recycling, MBT biostab 1	Dry AD with electricity generation	mid -f	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.28	2031	594.27	105.12	50.39

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
mid -d recycling, MBT AD 2 (SRF), SRF to cement_kiln	67%	66%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
mid -f recycling, MHT 2, SRF to cement_kiln	71%	61%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
lo recycling, MBT aerobic 4, SRF to cement_kiln	72%	73%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
lo recycling, MBT aerobic 2 (landfill)	68%	0%
mid -f recycling, MBT aerobic 2 (landfill)	66%	0%
lo recycling, MBT biostab 1	67%	0%
mid -f recycling, MBT biostab 1	65%	0%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	hi	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.32	2031	624.78	119.76	43.73
hi recycling, MBT biostab 1	Dry AD with electricity generation	hi	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.32	2031	623.30	119.76	43.34
mid -d recycling, MBT aerobic 2 (landfill)	Dry AD with electricity generation	mid -d	MBT aerobic 2 (landfill)	#N/A	0%	0%	-	0%	110.46	-0.31	2031	543.77	96.27	46.02
mid -d recycling, MBT biostab 1	Dry AD with electricity generation	mid -d	MBT biostab 1	#N/A	0%	0%	-	0%	110.46	-0.31	2031	540.89	96.27	45.26
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	110.69	-0.46	2031	583.18	109.48	43.12
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	111.45	-0.42	2031	594.06	105.12	50.33
hi recycling, MHT 2, SRF to cement_kiln	Wet AD with electricity generation	hi	MHT 2	cement_kiln	0%	100%	-	55%	112.19	-0.46	2031	612.17	119.76	40.43
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	lo	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	62%	113.01	-0.46	2031	583.15	109.48	43.11
lo recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	lo	MHT 1	cement_kiln	0%	100%	-	64%	113.06	-0.44	2031	607.14	109.48	49.39
lo recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	lo	MHT 1	cement_kiln	0%	100%	-	64%	116.61	-0.44	2031	607.11	109.48	49.38
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	117.54	-0.47	2031	567.22	105.12	43.31
mid -f recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	118.73	-0.44	2031	591.76	105.12	49.73
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	119.26	-0.40	2031	597.87	105.12	51.33
hi recycling, MHT 2, SRF to cement_kiln	Dry AD with electricity generation	hi	MHT 2	cement_kiln	0%	100%	-	55%	120.49	-0.43	2031	618.31	119.76	42.03
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	120.63	-0.46	2031	571.03	105.12	44.30
hi recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	121.76	-0.43	2031	619.41	119.76	42.32
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	122.60	-0.42	2031	550.71	96.27	47.83
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	122.60	-0.42	2031	550.39	96.27	47.75
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	mid -f	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	58%	123.01	-0.46	2031	571.00	105.12	44.30
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	123.14	-0.41	2031	551.30	96.27	47.99

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT aerobic 2 (landfill)	75%	0%
hi recycling, MBT biostab 1	75%	0%
mid -d recycling, MBT aerobic 2 (landfill)	66%	0%
mid -d recycling, MBT biostab 1	66%	0%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
lo recycling, MBT AD 2 (SRF), SRF to cement_kiln	68%	62%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
lo recycling, MHT 1, SRF to cement_kiln	72%	64%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	76%	70%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	76%	70%
mid -f recycling, MBT AD 2 (SRF), SRF to cement_kiln	66%	58%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	123.21	-0.42	2031	595.57	105.12	50.73
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	mid -f	MBT aerobic 4	cement_kiln	0%	100%	-	68%	125.59	-0.40	2031	597.85	105.12	51.32
lo recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	126.58	-0.39	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	126.58	-0.39	2031	579.28	109.48	42.10
hi recycling, MHT 1, SRF to cement_kiln	Wet AD with electricity generation	hi	MHT 1	cement_kiln	0%	100%	-	55%	126.76	-0.44	2031	612.17	119.76	40.43
mid -f recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	mid -f	MHT 1	cement_kiln	0%	100%	-	61%	126.95	-0.42	2031	595.55	105.12	50.72
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Wet AD with electricity generation	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	127.09	-0.47	2031	595.36	119.76	36.03
hi recycling, MHT 2, SRF to cement_kiln	Aerobic Digestion	hi	MHT 2	cement_kiln	0%	100%	-	55%	127.48	-0.43	2031	618.27	119.76	42.02
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	127.71	-0.41	2031	608.92	109.48	49.85
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	127.71	-0.41	2031	608.23	109.48	49.67
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	128.91	-0.40	2031	553.40	96.27	48.54
NC recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	129.10	-0.32	2031	588.97	83.05	71.07
NC recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	129.10	-0.32	2031	588.80	83.05	71.02
NC recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	131.24	-0.33	2031	587.44	83.05	70.67
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	131.85	-0.40	2031	620.72	119.76	42.66
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	131.85	-0.40	2031	619.78	119.76	42.42
NC recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	131.90	-0.32	2031	588.54	83.05	70.96
NC recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	NC	MBT aerobic 3	cement_kiln	0%	100%	-	50%	132.51	-0.32	2031	588.53	83.05	70.95
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Dry AD with electricity generation	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	133.39	-0.44	2031	601.50	119.76	37.63
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	mid -d	MBT aerobic 4	cement_kiln	0%	100%	-	65%	134.46	-0.40	2031	553.39	96.27	48.53

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
mid -f recycling, MBT aerobic 4, SRF to cement_kiln	71%	68%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
mid -f recycling, MHT 1, SRF to cement_kiln	71%	61%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
hi recycling, MHT 2, SRF to cement_kiln	80%	55%
lo recycling, MHT 2, SRF to Gasification_CHP_generic	77%	64%
lo recycling, MHT 2, SRF to Gasification_CHP_generic	77%	64%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
hi recycling, MHT 2, SRF to Gasification_CHP_generic	84%	55%
hi recycling, MHT 2, SRF to Gasification_CHP_generic	84%	55%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
NC recycling, MBT aerobic 3, SRF to cement_kiln	33%	50%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
mid -d recycling, MBT aerobic 4, SRF to cement_kiln	71%	65%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	134.77	-0.38	2031	642.63	83.05	85.11
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	134.77	-0.38	2031	642.46	83.05	85.07
hi recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	135.46	-0.41	2031	627.96	119.76	44.56
hi recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	135.46	-0.41	2031	627.02	119.76	44.31
hi recycling, MHT 1, SRF to cement_kiln	Dry AD with electricity generation	hi	MHT 1	cement_kiln	0%	100%	-	55%	136.14	-0.41	2031	618.31	119.76	42.03
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	136.26	-0.43	2031	547.78	96.27	47.06
hi recycling, MBT aerobic 4, SRF to cement_kiln	Dry AD with electricity generation	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	136.76	-0.40	2031	625.55	119.76	43.93
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	138.20	-0.38	2031	641.10	83.05	84.71
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	139.21	-0.38	2031	642.20	83.05	85.00
lo recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	139.49	-0.42	2031	608.48	109.48	49.74
lo recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	139.49	-0.42	2031	607.78	109.48	49.56
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	Aerobic Digestion	hi	MBT AD 2 (SRF)	cement_kiln	0%	100%	-	54%	140.02	-0.44	2031	601.46	119.76	37.62
NC recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	NC	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	140.29	-0.38	2031	642.19	83.05	85.00
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	140.72	-0.42	2031	549.88	96.27	47.62
hi recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	140.72	-0.39	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	140.72	-0.39	2031	602.17	119.76	37.81
lo recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	141.96	-0.41	2031	573.64	109.48	40.62
lo recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	142.25	-0.37	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	142.25	-0.37	2031	579.28	109.48	42.10
hi recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	143.72	-0.37	2031	627.96	119.76	44.56

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MHT 2, SRF to Gasification_CHP_generic	52%	70%
NC recycling, MHT 2, SRF to Gasification_CHP_generic	52%	70%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic		
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
NC recycling, MHT 2, SRF to Gasification_CHP_generic		
NC recycling, MHT 2, SRF to Gasification_CHP_generic	52%	70%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
hi recycling, MBT AD 2 (SRF), SRF to cement_kiln	76%	54%
NC recycling, MHT 2, SRF to Gasification_CHP_generic	52%	70%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	76%	70%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	143.72	-0.37	2031	627.02	119.76	44.31
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	144.57	-0.38	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	144.57	-0.38	2031	567.18	105.12	43.30
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to transport fuel	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	145.10	-0.40	2031	597.07	105.12	51.12
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with biogas to grid injection	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	145.10	-0.40	2031	596.48	105.12	50.97
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	mid -d	MHT 2	Gasification_CHP_generic	32%	26%	-	70%	145.84	-0.42	2031	549.87	96.27	47.61
lo recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	146.81	-0.39	2031	578.19	109.48	41.81
hi recycling, MHT 1, SRF to cement_kiln	Aerobic Digestion	hi	MHT 1	cement_kiln	0%	100%	-	55%	147.11	-0.41	2031	618.27	119.76	42.02
NC recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	148.38	-0.29	2031	588.97	83.05	71.07
NC recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	148.38	-0.29	2031	588.80	83.05	71.02
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	150.20	-0.39	2031	519.91	96.27	39.77
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	150.20	-0.39	2031	519.59	96.27	39.69
NC recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	151.21	-0.29	2031	587.44	83.05	70.67
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	151.83	-0.44	2031	602.59	109.48	48.20
NC recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	151.97	-0.29	2031	588.54	83.05	70.96
lo recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	152.19	-0.37	2031	608.48	109.48	49.74
lo recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	152.19	-0.37	2031	607.78	109.48	49.56
NC recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	NC	MBT aerobic 1	cement_kiln	0%	100%	-	50%	152.93	-0.29	2031	588.53	83.05	70.95
lo recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	lo	MBT aerobic 3	cement_kiln	0%	100%	-	43%	152.97	-0.39	2031	578.16	109.48	41.80
hi recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	154.67	-0.37	2031	603.11	119.76	38.06

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	76%	61%
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	76%	61%
mid -d recycling, MHT 2, SRF to Gasification_CHP_generic	76%	70%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
hi recycling, MHT 1, SRF to cement_kiln	80%	55%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
lo recycling, MHT 2, SRF to Gasification_CHP_generic		
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
NC recycling, MBT aerobic 1, SRF to cement_kiln	33%	50%
lo recycling, MBT aerobic 3, SRF to cement_kiln	68%	43%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	154.67	-0.37	2031	602.17	119.76	37.81
hi recycling, MBT aerobic 4, SRF to cement_kiln	Aerobic Digestion	hi	MBT aerobic 4	cement_kiln	0%	100%	-	60%	156.71	-0.40	2031	625.51	119.76	43.92
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	158.01	-0.39	2031	562.45	105.12	42.06
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	158.14	-0.37	2031	627.96	119.76	44.56
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	158.14	-0.37	2031	627.02	119.76	44.31
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	159.38	-0.41	2031	607.14	109.48	49.39
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	160.33	-0.40	2031	516.98	96.27	39.00
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	161.73	-0.38	2031	566.26	105.12	43.06
lo recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	161.96	-0.39	2031	573.64	109.48	40.62
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	162.65	-0.36	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	162.65	-0.36	2031	567.18	105.12	43.30
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	163.02	-0.39	2031	519.08	96.27	39.55
hi recycling, MBT aerobic 3, SRF to cement_kiln	Wet AD with electricity generation	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	165.19	-0.42	2031	594.56	119.76	35.82
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	mid -d	MBT aerobic 3	cement_kiln	0%	100%	-	40%	167.08	-0.39	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	mid -f	MBT aerobic 3	cement_kiln	0%	100%	-	38%	167.33	-0.38	2031	566.24	105.12	43.05
lo recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	167.50	-0.37	2031	578.19	109.48	41.81
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	167.59	-0.37	2031	608.48	109.48	49.74
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	167.59	-0.37	2031	607.78	109.48	49.56
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	168.14	-0.42	2031	591.76	105.12	49.73
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	168.82	-0.37	2031	519.91	96.27	39.77

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
hi recycling, MBT aerobic 4, SRF to cement_kiln	80%	60%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
lo recycling, MHT 2, SRF to Gasification_CHP_generic	77%	64%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
mid -d recycling, MBT aerobic 3, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 3, SRF to cement_kiln	66%	38%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic		
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with biogas to grid injection	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	168.82	-0.37	2031	519.59	96.27	39.69
hi recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MHT 2	power_station_generic	36%	0%	-	55%	170.26	-0.43	2031	620.72	119.76	42.66
hi recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MHT 2	power_station_generic	36%	0%	-	55%	170.26	-0.43	2031	619.78	119.76	42.42
lo recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	lo	MHT 2	Gasification_CHP_generic	32%	26%	-	64%	171.25	-0.41	2031	607.11	109.48	49.38
hi recycling, MBT aerobic 3, SRF to cement_kiln	Dry AD with electricity generation	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	172.14	-0.39	2031	600.70	119.76	37.43
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	173.76	-0.41	2031	599.37	105.12	51.72
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	173.76	-0.41	2031	598.79	105.12	51.57
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Wet AD with electricity generation	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	174.38	-0.43	2031	612.17	119.76	40.43
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	174.49	-0.40	2031	595.57	105.12	50.73
lo recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	lo	MBT aerobic 1	cement_kiln	0%	100%	-	43%	176.72	-0.37	2031	578.16	109.48	41.80
lo recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MHT 2	power_station_generic	36%	0%	-	64%	177.49	-0.45	2031	608.92	109.48	49.85
lo recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MHT 2	power_station_generic	36%	0%	-	64%	177.49	-0.45	2031	608.23	109.48	49.67
mid -d recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	179.83	-0.45	2031	550.71	96.27	47.83
mid -d recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	179.83	-0.45	2031	550.39	96.27	47.75
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	179.87	-0.38	2031	562.45	105.12	42.06
hi recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MHT 1	power_station_generic	36%	0%	-	55%	181.72	-0.41	2031	620.72	119.76	42.66
hi recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MHT 1	power_station_generic	36%	0%	-	55%	181.72	-0.41	2031	619.78	119.76	42.42
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	181.72	-0.38	2031	516.98	96.27	39.00
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	184.10	-0.36	2031	566.26	105.12	43.06
hi recycling, MBT aerobic 3, SRF to cement_kiln	Aerobic Digestion	hi	MBT aerobic 3	cement_kiln	0%	100%	-	33%	184.62	-0.39	2031	600.66	119.76	37.42

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
lo recycling, MHT 2, SRF to Gasification_CHP_generic	77%	64%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
hi recycling, MHT 2, SRF to Gasification_CHP_generic		
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	76%	61%
lo recycling, MBT aerobic 1, SRF to cement_kiln	68%	43%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 3, SRF to cement_kiln	75%	33%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MBT aerobic 1, SRF to cement_kiln	Wet AD with electricity generation	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	184.75	-0.40	2031	594.56	119.76	35.82
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	184.78	-0.37	2031	519.08	96.27	39.55
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	mid -f	MHT 2	Gasification_CHP_generic	32%	26%	-	61%	186.04	-0.40	2031	595.55	105.12	50.72
hi recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MHT 2	ATT_generic	30%	0%	-	55%	186.68	-0.35	2031	620.72	119.76	42.66
hi recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MHT 2	ATT_generic	30%	0%	-	55%	186.68	-0.35	2031	619.78	119.76	42.42
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Dry AD with electricity generation	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	187.28	-0.40	2031	618.31	119.76	42.03
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	mid -d	MBT aerobic 1	cement_kiln	0%	100%	-	40%	190.57	-0.37	2031	519.07	96.27	39.55
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	191.17	-0.36	2031	599.37	105.12	51.72
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	191.17	-0.36	2031	598.79	105.12	51.57
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	mid -f	MBT aerobic 1	cement_kiln	0%	100%	-	38%	192.23	-0.36	2031	566.24	105.12	43.05
hi recycling, MBT aerobic 1, SRF to cement_kiln	Dry AD with electricity generation	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	192.52	-0.37	2031	600.70	119.76	37.43
lo recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MHT 1	power_station_generic	36%	0%	-	64%	194.57	-0.43	2031	608.92	109.48	49.85
lo recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MHT 1	power_station_generic	36%	0%	-	64%	194.57	-0.43	2031	608.23	109.48	49.67
hi recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MHT 1	ATT_generic	30%	0%	-	55%	197.88	-0.35	2031	620.72	119.76	42.66
hi recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MHT 1	ATT_generic	30%	0%	-	55%	197.88	-0.35	2031	619.78	119.76	42.42
lo recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MHT 2	ATT_generic	30%	0%	-	64%	200.77	-0.35	2031	608.92	109.48	49.85
lo recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MHT 2	ATT_generic	30%	0%	-	64%	200.77	-0.35	2031	608.23	109.48	49.67
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	203.82	-0.45	2031	584.97	109.48	43.59
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	203.82	-0.45	2031	584.27	109.48	43.40
mid -d recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	205.31	-0.43	2031	550.71	96.27	47.83

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
mid -f recycling, MHT 2, SRF to Gasification_CHP_generic	76%	61%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
hi recycling, MHT 2, SRF to Gasification_CHP_generic	84%	55%
mid -d recycling, MBT aerobic 1, SRF to cement_kiln	66%	40%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
mid -f recycling, MBT aerobic 1, SRF to cement_kiln	66%	38%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	205.31	-0.43	2031	550.39	96.27	47.75
mid -f recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	205.68	-0.44	2031	597.07	105.12	51.12
mid -f recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	205.68	-0.44	2031	596.48	105.12	50.97
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MHT 2	incineration_generic	30%	0%	-	55%	205.89	-0.35	2031	620.72	119.76	42.66
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MHT 2	incineration_generic	30%	0%	-	55%	205.89	-0.35	2031	619.78	119.76	42.42
NC recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	206.76	-0.38	2031	645.86	83.05	85.96
NC recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	206.76	-0.38	2031	645.69	83.05	85.91
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	207.08	-0.44	2031	603.91	119.76	38.26
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	207.08	-0.44	2031	602.97	119.76	38.02
mid -d recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	208.58	-0.37	2031	550.71	96.27	47.83
mid -d recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	208.58	-0.37	2031	550.39	96.27	47.75
lo recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	208.65	-0.44	2031	602.15	109.48	48.08
hi recycling, MBT aerobic 1, SRF to cement_kiln	Aerobic Digestion	hi	MBT aerobic 1	cement_kiln	0%	100%	-	33%	209.74	-0.37	2031	600.66	119.76	37.42
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	210.87	-0.35	2031	599.37	105.12	51.72
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	210.87	-0.35	2031	598.79	105.12	51.57
mid -d recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	211.01	-0.46	2031	547.78	96.27	47.06
NC recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MHT 2	power_station_generic	36%	0%	-	70%	212.88	-0.45	2031	642.63	83.05	85.11
NC recycling, MHT 2, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MHT 2	power_station_generic	36%	0%	-	70%	212.88	-0.45	2031	642.46	83.05	85.07
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	216.55	-0.41	2031	554.23	96.27	48.75
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	216.55	-0.41	2031	553.91	96.27	48.67

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
hi recycling, MBT aerobic 1, SRF to cement_kiln	75%	33%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	216.78	-0.46	2031	527.31	96.27	41.71
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	216.78	-0.46	2031	526.99	96.27	41.62
hi recycling, MHT 2, SRF to Gasification_CHP_generic	Aerobic Digestion	hi	MHT 2	Gasification_CHP_generic	32%	26%	-	55%	217.51	-0.40	2031	618.27	119.76	42.02
mid -d recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	217.94	-0.45	2031	549.88	96.27	47.62
lo recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		218.09	-0.36	2031	573.12	109.48	40.49
lo recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		218.09	-0.36	2031	572.42	109.48	40.30
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MHT 1	incineration_generic	30%	0%	-	55%	218.34	-0.34	2031	620.72	119.76	42.66
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MHT 1	incineration_generic	30%	0%	-	55%	218.34	-0.34	2031	619.78	119.76	42.42
lo recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MHT 1	ATT_generic	30%	0%	-	64%	218.53	-0.34	2031	608.92	109.48	49.85
lo recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MHT 1	ATT_generic	30%	0%	-	64%	218.53	-0.34	2031	608.23	109.48	49.67
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MHT 2	incineration_generic	30%	0%	-	64%	221.47	-0.34	2031	608.92	109.48	49.85
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MHT 2	incineration_generic	30%	0%	-	64%	221.47	-0.34	2031	608.23	109.48	49.67
NC recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	NC	MHT 2	power_station_generic	36%	0%	-	70%	221.61	-0.46	2031	641.10	83.05	84.71
NC recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	NC	MHT 2	power_station_generic	36%	0%	-	70%	223.24	-0.45	2031	642.20	83.05	85.00
NC recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	223.37	-0.39	2031	644.33	83.05	85.55
NC recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	226.58	-0.38	2031	645.43	83.05	85.84
mid -f recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	227.32	-0.41	2031	597.07	105.12	51.12
mid -f recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	227.32	-0.41	2031	596.48	105.12	50.97
NC recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	NC	MHT 2	power_station_generic	36%	0%	-	70%	227.35	-0.45	2031	642.19	83.05	85.00
NC recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		227.57	-0.29	2031	566.44	83.05	65.17

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
hi recycling, MHT 2, SRF to Gasification_CHP_generic	84%	55%
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
lo recycling, Incineration 4 (high CHP)_total	74%	57%
lo recycling, Incineration 4 (high CHP)_total	74%	57%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
NC recycling, MHT 2, SRF to power_station_generic	51%	70%
NC recycling, Incineration 4 (high CHP)_total	46%	62%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		227.57	-0.29	2031	566.27	83.05	65.13
lo recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	lo	MHT 2	power_station_generic	36%	0%	-	64%	228.07	-0.47	2031	602.59	109.48	48.20
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	228.42	-0.34	2031	603.91	119.76	38.26
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	228.42	-0.34	2031	602.97	119.76	38.02
lo recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	228.47	-0.42	2031	606.69	109.48	49.27
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	230.05	-0.33	2031	584.97	109.48	43.59
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	230.05	-0.33	2031	584.27	109.48	43.40
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	230.06	-0.36	2031	550.71	96.27	47.83
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	230.06	-0.36	2031	550.39	96.27	47.75
NC recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		231.63	-0.30	2031	564.91	83.05	64.77
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	232.17	-0.45	2031	596.80	83.05	73.12
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	232.17	-0.45	2031	596.63	83.05	73.07
NC recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		232.35	-0.29	2031	566.01	83.05	65.06
hi recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	233.17	-0.44	2031	619.41	119.76	42.32
NC recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	NC	Incineration 4 (high CHP)_total	#N/A	16%	40%	62%		234.22	-0.29	2031	566.00	83.05	65.06
mid -f recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	234.75	-0.33	2031	597.07	105.12	51.12
mid -f recycling, MHT 2, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	234.75	-0.33	2031	596.48	105.12	50.97
NC recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	NC	MBT aerobic 4	power_station_generic	36%	0%	-	79%	235.05	-0.38	2031	645.42	83.05	85.84
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	235.85	-0.45	2031	572.52	105.12	44.70
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	235.85	-0.45	2031	571.94	105.12	44.54

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, Incineration 4 (high CHP)_total	46%	62%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
NC recycling, Incineration 4 (high CHP)_total	46%	62%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
NC recycling, Incineration 4 (high CHP)_total	46%	62%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
NC recycling, Incineration 4 (high CHP)_total	46%	62%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
NC recycling, MBT aerobic 4, SRF to power_station_generic	45%	79%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	mid -d	MHT 2	power_station_generic	36%	0%	-	70%	236.36	-0.45	2031	549.87	96.27	47.61
mid -d recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	236.44	-0.36	2031	550.71	96.27	47.83
mid -d recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	236.44	-0.36	2031	550.39	96.27	47.75
lo recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	237.83	-0.39	2031	602.15	109.48	48.08
lo recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	lo	MHT 2	power_station_generic	36%	0%	-	64%	239.46	-0.45	2031	607.14	109.48	49.39
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	239.52	-0.46	2031	595.27	83.05	72.72
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	240.79	-0.45	2031	596.37	83.05	73.00
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MHT 1	incineration_generic	30%	0%	-	64%	241.17	-0.33	2031	608.92	109.48	49.85
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MHT 1	incineration_generic	30%	0%	-	64%	241.17	-0.33	2031	608.23	109.48	49.67
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	242.24	-0.37	2031	554.23	96.27	48.75
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	242.24	-0.37	2031	553.91	96.27	48.67
mid -d recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		244.09	-0.39	2031	515.48	96.27	38.61
mid -d recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		244.09	-0.39	2031	515.16	96.27	38.53
NC recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MHT 1	power_station_generic	36%	0%	-	70%	244.12	-0.40	2031	642.63	83.05	85.11
NC recycling, MHT 1, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MHT 1	power_station_generic	36%	0%	-	70%	244.12	-0.40	2031	642.46	83.05	85.07
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	NC	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	68%	244.32	-0.45	2031	596.36	83.05	73.00
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	244.39	-0.47	2031	524.39	96.27	40.94
hi recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		244.81	-0.36	2031	594.64	119.76	35.84
hi recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		244.81	-0.36	2031	593.71	119.76	35.60
NC recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	246.01	-0.27	2031	645.86	83.05	85.96

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, MHT 2, SRF to power_station_generic	76%	70%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
NC recycling, MBT AD 2 (SRF), SRF to power_station_generic	45%	68%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	246.01	-0.27	2031	645.69	83.05	85.91
mid -d recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	246.97	-0.44	2031	547.78	96.27	47.06
lo recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		247.72	-0.38	2031	566.79	109.48	38.83
hi recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	hi	MHT 2	power_station_generic	36%	0%	-	55%	249.04	-0.46	2031	612.17	119.76	40.43
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	249.48	-0.46	2031	526.49	96.27	41.49
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	249.75	-0.35	2031	527.31	96.27	41.71
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	249.75	-0.35	2031	526.99	96.27	41.62
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	249.97	-0.47	2031	578.64	109.48	41.93
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	250.30	-0.43	2031	594.06	105.12	50.33
mid -d recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	251.48	-0.38	2031	547.78	96.27	47.06
mid -f recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		252.09	-0.35	2031	559.46	105.12	41.28
mid -f recycling, Incineration 4 (high CHP)_total	Wet AD with biogas to grid injection	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		252.09	-0.35	2031	558.88	105.12	41.13
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	252.38	-0.33	2031	603.91	119.76	38.26
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	252.38	-0.33	2031	602.97	119.76	38.02
lo recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		253.15	-0.36	2031	571.33	109.48	40.02
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	254.11	-0.32	2031	584.97	109.48	43.59
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	254.11	-0.32	2031	584.27	109.48	43.40
mid -d recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	255.09	-0.43	2031	549.88	96.27	47.62
mid -f recycling, MHT 2, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	255.54	-0.46	2031	591.76	105.12	49.73
NC recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	NC	MHT 1	power_station_generic	36%	0%	-	70%	255.67	-0.41	2031	641.10	83.05	84.71

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%
lo recycling, Incineration 4 (high CHP)_total	74%	57%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
lo recycling, Incineration 4 (high CHP)_total	74%	57%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	lo	MHT 1	power_station_generic	36%	0%	-	64%	257.06	-0.45	2031	602.59	109.48	48.20
NC recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	NC	MHT 1	power_station_generic	36%	0%	-	70%	257.56	-0.40	2031	642.20	83.05	85.00
mid -f recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	257.67	-0.32	2031	597.07	105.12	51.12
mid -f recycling, MHT 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	257.67	-0.32	2031	596.48	105.12	50.97
hi recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	257.92	-0.40	2031	619.41	119.76	42.32
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	259.02	-0.45	2031	583.18	109.48	43.12
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	259.08	-0.32	2031	597.07	105.12	51.12
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	259.08	-0.32	2031	596.48	105.12	50.97
mid -d recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	259.70	-0.37	2031	549.88	96.27	47.62
lo recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	260.27	-0.36	2031	562.03	109.48	37.58
lo recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	260.27	-0.36	2031	561.33	109.48	37.40
lo recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	260.33	-0.37	2031	606.69	109.48	49.27
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	260.91	-0.35	2031	550.71	96.27	47.83
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	260.91	-0.35	2031	550.39	96.27	47.75
mid -d recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		261.17	-0.40	2031	512.55	96.27	37.85
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	261.19	-0.39	2031	602.15	109.48	48.08
hi recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	hi	MBT aerobic 4	power_station_generic	36%	0%	-	60%	262.01	-0.41	2031	625.55	119.76	43.93
NC recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	NC	MHT 1	power_station_generic	36%	0%	-	70%	263.44	-0.40	2031	642.19	83.05	85.00
mid -d recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		263.96	-0.39	2031	514.65	96.27	38.40
lo recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	265.01	-0.41	2031	579.97	109.48	42.28

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
hi recycling, MBT aerobic 4, SRF to power_station_generic	81%	60%
NC recycling, MHT 1, SRF to power_station_generic	51%	70%
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	265.01	-0.41	2031	579.28	109.48	42.10
mid -f recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	265.23	-0.44	2031	595.57	105.12	50.73
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	mid -d	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	66%	265.48	-0.46	2031	526.48	96.27	41.49
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	266.83	-0.33	2031	599.19	119.76	37.03
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	266.83	-0.33	2031	598.25	119.76	36.78
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	267.48	-0.37	2031	554.23	96.27	48.75
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	267.48	-0.37	2031	553.91	96.27	48.67
hi recycling, MHT 2, SRF to power_station_generic	Dry AD with electricity generation	hi	MHT 2	power_station_generic	36%	0%	-	55%	267.54	-0.43	2031	618.31	119.76	42.03
lo recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	lo	MHT 2	ATT_generic	30%	0%	-	64%	267.59	-0.37	2031	602.59	109.48	48.20
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	267.92	-0.41	2031	597.87	105.12	51.33
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	268.33	-0.32	2031	572.52	105.12	44.70
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	268.33	-0.32	2031	571.94	105.12	44.54
NC recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	NC	MHT 2	ATT_generic	30%	0%	-	70%	269.14	-0.24	2031	641.10	83.05	84.71
NC recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	269.76	-0.28	2031	644.33	83.05	85.55
lo recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	lo	MHT 1	power_station_generic	36%	0%	-	64%	269.90	-0.43	2031	607.14	109.48	49.39
hi recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	270.46	-0.41	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	270.46	-0.41	2031	602.17	119.76	37.81
lo recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	lo	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		270.70	-0.36	2031	571.31	109.48	40.01
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	271.32	-0.27	2031	645.86	83.05	85.96
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	271.32	-0.27	2031	645.69	83.05	85.91

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
mid -d recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	66%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
NC recycling, MHT 2, SRF to Gasification 1	52%	70%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
lo recycling, Incineration 4 (high CHP)_total	74%	57%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	mid -d	Incineration 4 (high CHP)_total	#N/A	16%	40%	57%		273.11	-0.39	2031	514.64	96.27	38.39
NC recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	273.62	-0.27	2031	645.43	83.05	85.84
hi recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	hi	MHT 1	power_station_generic	36%	0%	-	55%	274.35	-0.44	2031	612.17	119.76	40.43
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	275.88	-0.34	2031	527.31	96.27	41.71
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	275.88	-0.34	2031	526.99	96.27	41.62
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	276.88	-0.37	2031	547.78	96.27	47.06
lo recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	lo	MHT 2	power_station_generic	36%	0%	-	64%	277.57	-0.45	2031	607.11	109.48	49.38
mid -f recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		278.65	-0.37	2031	554.16	105.12	39.89
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	279.12	-0.47	2031	595.36	119.76	36.03
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Wet AD with electricity generation	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	279.38	-0.46	2031	567.22	105.12	43.31
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	279.71	-0.31	2031	577.01	109.48	41.50
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	279.71	-0.31	2031	576.31	109.48	41.32
lo recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	lo	MHT 2	ATT_generic	30%	0%	-	64%	280.90	-0.35	2031	607.14	109.48	49.39
mid -f recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		282.86	-0.35	2031	557.97	105.12	40.89
mid -d recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	mid -d	MHT 1	power_station_generic	36%	0%	-	70%	282.95	-0.43	2031	549.87	96.27	47.61
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	283.08	-0.40	2031	619.41	119.76	42.32
lo recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		283.15	-0.30	2031	580.27	109.48	42.36
lo recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		283.15	-0.30	2031	579.58	109.48	42.18
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT aerobic 4	incineration_generic	30%	0%	-	73%	283.52	-0.37	2031	606.69	109.48	49.27
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	284.50	-0.31	2031	597.07	105.12	51.12

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, Incineration 4 (high CHP)_total	74%	57%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
lo recycling, MHT 2, SRF to power_station_generic	76%	64%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
mid -d recycling, MHT 1, SRF to power_station_generic	76%	70%
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
lo recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	74%	73%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	284.50	-0.31	2031	596.48	105.12	50.97
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	285.01	-0.36	2031	549.88	96.27	47.62
hi recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	hi	MHT 2	ATT_generic	30%	0%	-	55%	285.16	-0.38	2031	612.17	119.76	40.43
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	286.76	-0.45	2031	571.03	105.12	44.30
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	286.92	-0.36	2031	524.39	96.27	40.94
NC recycling, MBT aerobic 4, SRF to Gasification 1	Aerobic Digestion	NC	MBT aerobic 4	ATT_generic	30%	0%	-	79%	287.15	-0.27	2031	645.42	83.05	85.84
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	287.31	-0.35	2031	562.03	109.48	37.58
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	287.31	-0.35	2031	561.33	109.48	37.40
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	287.47	-0.38	2031	594.06	105.12	50.33
hi recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	hi	MBT aerobic 1	power_station_generic	36%	0%	-	33%	288.55	-0.39	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	hi	MBT aerobic 1	power_station_generic	36%	0%	-	33%	288.55	-0.39	2031	602.17	119.76	37.81
mid -d recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	mid -d	MHT 2	ATT_generic	30%	0%	-	70%	288.74	-0.37	2031	549.87	96.27	47.61
lo recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	289.12	-0.38	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	289.12	-0.38	2031	579.28	109.48	42.10
hi recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	hi	MBT aerobic 4	ATT_generic	30%	0%	-	60%	289.69	-0.37	2031	625.55	119.76	43.93
mid -f recycling, MHT 1, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	289.82	-0.43	2031	591.76	105.12	49.73
hi recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	290.21	-0.35	2031	586.63	119.76	33.74
hi recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	290.21	-0.35	2031	585.69	119.76	33.50
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	290.25	-0.35	2031	578.64	109.48	41.93
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Wet AD with electricity generation	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	290.75	-0.42	2031	551.30	96.27	47.99

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
NC recycling, MBT aerobic 4, SRF to Gasification 1	46%	79%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
hi recycling, MBT aerobic 1, SRF to power_station_generic	78%	33%
hi recycling, MBT aerobic 1, SRF to power_station_generic	78%	33%
mid -d recycling, MHT 2, SRF to Gasification 1	76%	70%
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
hi recycling, MBT aerobic 4, SRF to Gasification 1	82%	60%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	lo	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	62%	291.38	-0.45	2031	583.15	109.48	43.11
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	292.86	-0.35	2031	526.49	96.27	41.49
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Dry AD with electricity generation	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	293.03	-0.44	2031	601.50	119.76	37.63
mid -d recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	293.12	-0.37	2031	547.78	96.27	47.06
hi recycling, Incineration 4 (high CHP)_total	Wet AD with electricity generation	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		293.58	-0.39	2031	586.10	119.76	33.60
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MHT 2	incineration_generic	30%	0%	-	64%	294.49	-0.36	2031	602.59	109.48	48.20
hi recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	hi	MHT 1	power_station_generic	36%	0%	-	55%	294.73	-0.41	2031	618.31	119.76	42.03
lo recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		295.09	-0.29	2031	528.56	109.48	28.83
lo recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		295.09	-0.29	2031	527.87	109.48	28.65
lo recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		296.32	-0.28	2031	555.16	109.48	35.79
lo recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		296.32	-0.28	2031	554.46	109.48	35.60
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	296.50	-0.30	2031	572.52	105.12	44.70
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	296.50	-0.30	2031	571.94	105.12	44.54
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	297.22	-0.27	2031	644.33	83.05	85.55
mid -f recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	mid -f	Incineration 4 (high CHP)_total	#N/A	16%	40%	52%		298.42	-0.35	2031	557.94	105.12	40.88
lo recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MBT aerobic 3	ATT_generic	30%	0%	-	43%	299.18	-0.30	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MBT aerobic 3	ATT_generic	30%	0%	-	43%	299.18	-0.30	2031	579.28	109.48	42.10
hi recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MBT aerobic 3	ATT_generic	30%	0%	-	33%	299.52	-0.31	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MBT aerobic 3	ATT_generic	30%	0%	-	33%	299.52	-0.31	2031	602.17	119.76	37.81
lo recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	lo	MHT 1	ATT_generic	30%	0%	-	64%	300.11	-0.36	2031	602.59	109.48	48.20

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT AD 2 (SRF), SRF to power_station_generic	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
hi recycling, MHT 1, SRF to power_station_generic	83%	55%
lo recycling, Gasification Gas Engine 2_total	74%	57%
lo recycling, Gasification Gas Engine 2_total	74%	57%
lo recycling, True Pyrolysis 1_total	74%	57%
lo recycling, True Pyrolysis 1_total	74%	57%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
mid -f recycling, Incineration 4 (high CHP)_total	73%	52%
lo recycling, MBT aerobic 3, SRF to Gasification 1	71%	43%
lo recycling, MBT aerobic 3, SRF to Gasification 1	71%	43%
hi recycling, MBT aerobic 3, SRF to Gasification 1	78%	33%
hi recycling, MBT aerobic 3, SRF to Gasification 1	78%	33%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	300.71	-0.33	2031	583.18	109.48	43.12
mid -f recycling, MHT 1, SRF to power_station_generic	Dry AD with electricity generation	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	300.81	-0.41	2031	595.57	105.12	50.73
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	301.04	-0.27	2031	645.43	83.05	85.84
mid -f recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	mid -f	MHT 2	power_station_generic	36%	0%	-	61%	301.52	-0.44	2031	595.55	105.12	50.72
hi recycling, Incineration 4 (high CHP)_total	Dry AD with electricity generation	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		301.55	-0.36	2031	592.24	119.76	35.21
mid -f recycling, MHT 2, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	301.61	-0.35	2031	591.76	105.12	49.73
mid -d recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	302.71	-0.36	2031	549.88	96.27	47.62
lo recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	lo	MBT aerobic 4	power_station_generic	36%	0%	-	73%	303.30	-0.42	2031	606.67	109.48	49.26
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Dry AD with electricity generation	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	304.45	-0.41	2031	553.40	96.27	48.54
hi recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	hi	MHT 2	ATT_generic	30%	0%	-	55%	306.25	-0.35	2031	618.31	119.76	42.03
lo recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		307.37	-0.29	2031	542.15	109.48	32.38
lo recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		307.37	-0.29	2031	541.46	109.48	32.20
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MBT aerobic 4	ATT_generic	30%	0%	-	68%	307.61	-0.36	2031	597.87	105.12	51.33
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MHT 2	incineration_generic	30%	0%	-	64%	307.67	-0.34	2031	607.14	109.48	49.39
hi recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		308.92	-0.31	2031	600.05	119.76	37.25
hi recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		308.92	-0.31	2031	599.11	119.76	37.01
hi recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	hi	MHT 1	ATT_generic	30%	0%	-	55%	312.16	-0.38	2031	612.17	119.76	40.43
mid -f recycling, MHT 2, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	313.00	-0.33	2031	595.57	105.12	50.73
lo recycling, Gasification 1_total	Wet AD with biogas to transport fuel	lo	Gasification 1_total	#N/A	30%	0%	57%		313.64	-0.28	2031	467.41	109.48	12.82
lo recycling, Gasification 1_total	Wet AD with biogas to grid injection	lo	Gasification 1_total	#N/A	30%	0%	57%		313.64	-0.28	2031	466.71	109.48	12.64

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
mid -f recycling, MHT 2, SRF to power_station_generic	75%	61%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
lo recycling, MBT aerobic 4, SRF to power_station_generic	74%	73%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%
hi recycling, MHT 2, SRF to Gasification 1	84%	55%
lo recycling, Gasification Gas Engine 1_total	74%	57%
lo recycling, Gasification Gas Engine 1_total	74%	57%
mid -f recycling, MBT aerobic 4, SRF to Gasification 1	73%	68%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
lo recycling, Gasification 1_total	74%	57%
lo recycling, Gasification 1_total	74%	57%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MHT 2	incineration_generic	30%	0%	-	55%	313.65	-0.38	2031	612.17	119.76	40.43
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT aerobic 4	incineration_generic	30%	0%	-	60%	314.66	-0.37	2031	625.55	119.76	43.93
lo recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	lo	MHT 1	ATT_generic	30%	0%	-	64%	315.03	-0.34	2031	607.14	109.48	49.39
hi recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	hi	Gasification Gas Engine 2_total	#N/A	32%	0%	47%		315.92	-0.30	2031	561.00	119.76	27.04
hi recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	hi	Gasification Gas Engine 2_total	#N/A	32%	0%	47%		315.92	-0.30	2031	560.07	119.76	26.79
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	mid -f	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	58%	316.21	-0.45	2031	571.00	105.12	44.30
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	316.24	-0.37	2031	594.06	105.12	50.33
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	MBT aerobic 4	incineration_generic	30%	0%	-	79%	316.27	-0.27	2031	645.42	83.05	85.84
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	316.54	-0.35	2031	524.39	96.27	40.94
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	mid -d	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	66%	316.65	-0.35	2031	526.48	96.27	41.49
hi recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	hi	True Pyrolysis 1_total	#N/A	32%	0%	47%		316.87	-0.29	2031	581.08	119.76	32.29
hi recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	hi	True Pyrolysis 1_total	#N/A	32%	0%	47%		316.87	-0.29	2031	580.14	119.76	32.05
hi recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	hi	MBT aerobic 1	ATT_generic	30%	0%	-	33%	317.57	-0.30	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	hi	MBT aerobic 1	ATT_generic	30%	0%	-	33%	317.57	-0.30	2031	602.17	119.76	37.81
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MHT 2	incineration_generic	30%	0%	-	70%	317.68	-0.36	2031	549.87	96.27	47.61
NC recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	318.41	-0.28	2031	546.42	83.05	59.93
NC recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	318.41	-0.28	2031	546.25	83.05	59.89
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	318.79	-0.37	2031	595.36	119.76	36.03
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	319.30	-0.40	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	319.30	-0.40	2031	567.18	105.12	43.30

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
hi recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	82%	60%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
hi recycling, Gasification Gas Engine 2_total	80%	47%
hi recycling, Gasification Gas Engine 2_total	80%	47%
mid -f recycling, MBT AD 2 (SRF), SRF to power_station_generic	73%	58%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%
NC recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	46%	79%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -d recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	66%
hi recycling, True Pyrolysis 1_total	80%	47%
hi recycling, True Pyrolysis 1_total	80%	47%
hi recycling, MBT aerobic 1, SRF to Gasification 1	78%	33%
hi recycling, MBT aerobic 1, SRF to Gasification 1	78%	33%
mid -d recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	70%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	320.03	-0.34	2031	578.64	109.48	41.93
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	320.34	-0.34	2031	549.22	105.12	38.60
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	320.34	-0.34	2031	548.64	105.12	38.45
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	Dirty MRF 1	incineration_generic	30%	0%	-	52%	320.62	-0.34	2031	586.63	119.76	33.74
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	Dirty MRF 1	incineration_generic	30%	0%	-	52%	320.62	-0.34	2031	585.69	119.76	33.50
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	322.44	-0.34	2031	526.49	96.27	41.49
lo recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	lo	MHT 1	power_station_generic	36%	0%	-	64%	322.46	-0.43	2031	607.11	109.48	49.38
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	322.82	-0.36	2031	547.78	96.27	47.06
lo recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	lo	MBT aerobic 1	ATT_generic	30%	0%	-	43%	324.16	-0.29	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	lo	MBT aerobic 1	ATT_generic	30%	0%	-	43%	324.16	-0.29	2031	579.28	109.48	42.10
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Wet AD with electricity generation	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	325.84	-0.33	2031	567.22	105.12	43.31
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	327.08	-0.34	2031	517.04	96.27	39.02
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	327.08	-0.34	2031	516.72	96.27	38.94
hi recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	hi	Gasification Gas Engine 1_total	#N/A	30%	0%	47%		327.17	-0.29	2031	571.26	119.76	29.72
hi recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	hi	Gasification Gas Engine 1_total	#N/A	30%	0%	47%		327.17	-0.29	2031	570.33	119.76	29.48
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	327.53	-0.30	2031	564.30	105.12	42.54
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	51%	327.53	-0.30	2031	563.72	105.12	42.39
mid -d recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		327.94	-0.33	2031	522.68	96.27	40.50
mid -d recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		327.94	-0.33	2031	522.36	96.27	40.41
lo recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	328.77	-0.38	2031	555.70	109.48	35.93

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	82%	52%
hi recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	82%	52%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
lo recycling, MHT 1, SRF to power_station_generic	76%	64%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
lo recycling, MBT aerobic 1, SRF to Gasification 1	71%	43%
lo recycling, MBT aerobic 1, SRF to Gasification 1	71%	43%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%
hi recycling, Gasification Gas Engine 1_total	80%	47%
hi recycling, Gasification Gas Engine 1_total	80%	47%
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	51%
mid -f recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	51%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	330.16	-0.28	2031	544.89	83.05	59.53
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MHT 1	incineration_generic	30%	0%	-	64%	330.37	-0.35	2031	602.59	109.48	48.20
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	330.39	-0.32	2031	583.18	109.48	43.12
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT aerobic 3	incineration_generic	30%	0%	-	43%	330.52	-0.29	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT aerobic 3	incineration_generic	30%	0%	-	43%	330.52	-0.29	2031	579.28	109.48	42.10
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT aerobic 3	incineration_generic	30%	0%	-	33%	331.08	-0.30	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT aerobic 3	incineration_generic	30%	0%	-	33%	331.08	-0.30	2031	602.17	119.76	37.81
NC recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	331.63	-0.28	2031	545.99	83.05	59.82
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	332.15	-0.34	2031	591.76	105.12	49.73
mid -f recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		332.30	-0.29	2031	566.92	105.12	43.23
mid -f recycling, Incineration 3 (medium CHP)_total	Wet AD with biogas to grid injection	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		332.30	-0.29	2031	566.34	105.12	43.08
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	332.31	-0.35	2031	549.88	96.27	47.62
lo recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	lo	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		332.78	-0.27	2031	582.87	109.48	43.04
lo recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	lo	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		332.78	-0.27	2031	582.17	109.48	42.85
hi recycling, Gasification 1_total	Wet AD with biogas to transport fuel	hi	Gasification 1_total	#N/A	30%	0%	47%		332.87	-0.29	2031	514.83	119.76	14.95
hi recycling, Gasification 1_total	Wet AD with biogas to grid injection	hi	Gasification 1_total	#N/A	30%	0%	47%		332.87	-0.29	2031	513.89	119.76	14.71
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	334.41	-0.32	2031	571.03	105.12	44.30
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MHT 2	incineration_generic	30%	0%	-	55%	334.57	-0.35	2031	618.31	119.76	42.03
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	Dry AD with electricity generation	hi	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	54%	334.60	-0.34	2031	601.50	119.76	37.63
lo recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		335.20	-0.32	2031	573.94	109.48	40.70

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	71%	43%
lo recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	71%	43%
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	78%	33%
hi recycling, MBT aerobic 3, SRF to Incineration 1 (electricity only)	78%	33%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
lo recycling, Incineration 2 (low CHP)_total	74%	57%
lo recycling, Incineration 2 (low CHP)_total	74%	57%
hi recycling, Gasification 1_total	80%	47%
hi recycling, Gasification 1_total	80%	47%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
hi recycling, MHT 2, SRF to Incineration 1 (electricity only)	84%	55%
hi recycling, MBT AD 2 (SRF), SRF to Gasification 1	81%	54%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
hi recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	hi	MHT 1	ATT_generic	30%	0%	-	55%	335.24	-0.35	2031	618.31	119.76	42.03
hi recycling, Incineration 4 (high CHP)_total	Aerobic Digestion	hi	Incineration 4 (high CHP)_total	#N/A	16%	40%	47%		335.95	-0.36	2031	592.20	119.76	35.20
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MBT aerobic 4	incineration_generic	30%	0%	-	68%	336.21	-0.35	2031	597.87	105.12	51.33
NC recycling, Dirty MRF 1, SRF to Gasification 1	Aerobic Digestion	NC	Dirty MRF 1	ATT_generic	30%	0%	-	69%	338.05	-0.28	2031	545.98	83.05	59.82
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Wet AD with electricity generation	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	338.44	-0.38	2031	551.30	96.27	47.99
lo recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	lo	MHT 2	ATT_generic	30%	0%	-	64%	339.07	-0.35	2031	607.11	109.48	49.38
lo recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	339.29	-0.36	2031	560.24	109.48	37.12
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	340.52	-0.36	2031	507.85	96.27	36.62
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	340.52	-0.36	2031	507.53	96.27	36.53
mid -f recycling, MHT 1, SRF to Gasification 1	Wet AD with electricity generation	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	340.53	-0.34	2031	591.76	105.12	49.73
NC recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	340.54	-0.35	2031	588.97	83.05	71.07
NC recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	340.54	-0.35	2031	588.80	83.05	71.02
lo recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		342.55	-0.30	2031	578.49	109.48	41.89
lo recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	343.17	-0.43	2031	573.64	109.48	40.62
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MHT 2	incineration_generic	30%	0%	-	61%	343.42	-0.32	2031	595.57	105.12	50.73
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MHT 1	incineration_generic	30%	0%	-	55%	343.48	-0.37	2031	612.17	119.76	40.43
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MHT 1	incineration_generic	30%	0%	-	64%	345.16	-0.33	2031	607.14	109.48	49.39
mid -d recycling, MHT 1, SRF to Gasification 1	Aerobic Digestion	mid -d	MHT 1	ATT_generic	30%	0%	-	70%	345.66	-0.36	2031	549.87	96.27	47.61
lo recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to transport fuel	lo	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		346.34	-0.27	2031	523.66	109.48	27.54
lo recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to grid injection	lo	Incineration 1 (electricity only)_total	#N/A	30%	0%	57%		346.34	-0.27	2031	522.97	109.48	27.36

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
hi recycling, MHT 1, SRF to Gasification 1	84%	55%
hi recycling, Incineration 4 (high CHP)_total	80%	47%
mid -f recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	73%	68%
NC recycling, Dirty MRF 1, SRF to Gasification 1	50%	69%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
lo recycling, MHT 2, SRF to Gasification 1	77%	64%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%
mid -f recycling, MHT 2, SRF to Incineration 1 (electricity only)	76%	61%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
lo recycling, MHT 1, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MHT 1, SRF to Gasification 1	76%	70%
lo recycling, Incineration 1 (electricity only)_total	74%	57%
lo recycling, Incineration 1 (electricity only)_total	74%	57%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	mid -f	MBT aerobic 4	power_station_generic	36%	0%	-	68%	347.32	-0.41	2031	597.85	105.12	51.32
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	lo	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	62%	348.01	-0.33	2031	583.15	109.48	43.11
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	66%	349.19	-0.34	2031	526.48	96.27	41.49
mid -f recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		349.83	-0.28	2031	513.02	105.12	29.13
mid -f recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	mid -f	Gasification Gas Engine 2_total	#N/A	32%	0%	52%		349.83	-0.28	2031	512.44	105.12	28.97
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 3	power_station_generic	36%	0%	-	40%	349.84	-0.40	2031	519.91	96.27	39.77
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MBT aerobic 3	power_station_generic	36%	0%	-	40%	349.84	-0.40	2031	519.59	96.27	39.69
mid -d recycling, Gasification Gas Engine 2_total	Wet AD with biogas to transport fuel	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		349.92	-0.33	2031	470.62	96.27	26.88
mid -d recycling, Gasification Gas Engine 2_total	Wet AD with biogas to grid injection	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		349.92	-0.33	2031	470.30	96.27	26.79
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	350.42	-0.37	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -f	MBT aerobic 1	power_station_generic	36%	0%	-	38%	350.42	-0.37	2031	567.18	105.12	43.30
mid -f recycling, MHT 1, SRF to power_station_generic	Aerobic Digestion	mid -f	MHT 1	power_station_generic	36%	0%	-	61%	351.04	-0.41	2031	595.55	105.12	50.72
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	351.11	-0.26	2031	546.42	83.05	59.93
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	351.11	-0.26	2031	546.25	83.05	59.89
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	hi	MBT aerobic 1	incineration_generic	30%	0%	-	33%	351.16	-0.29	2031	603.11	119.76	38.06
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	hi	MBT aerobic 1	incineration_generic	30%	0%	-	33%	351.16	-0.29	2031	602.17	119.76	37.81
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	351.45	-0.36	2031	595.36	119.76	36.03
mid -f recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		351.51	-0.27	2031	540.74	105.12	36.38
mid -f recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	mid -f	True Pyrolysis 1_total	#N/A	32%	0%	52%		351.51	-0.27	2031	540.16	105.12	36.23
mid -d recycling, True Pyrolysis 1_total	Wet AD with biogas to transport fuel	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		351.89	-0.32	2031	497.39	96.27	33.88

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -f recycling, MBT aerobic 4, SRF to power_station_generic	73%	68%
lo recycling, MBT AD 2 (SRF), SRF to Gasification 1	74%	62%
mid -d recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	66%
mid -f recycling, Gasification Gas Engine 2_total	73%	52%
mid -f recycling, Gasification Gas Engine 2_total	73%	52%
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	69%	40%
mid -d recycling, MBT aerobic 3, SRF to power_station_generic	69%	40%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	68%	38%
mid -f recycling, MBT aerobic 1, SRF to power_station_generic	68%	38%
mid -f recycling, MHT 1, SRF to power_station_generic	75%	61%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	78%	33%
hi recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	78%	33%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
mid -f recycling, True Pyrolysis 1_total	73%	52%
mid -f recycling, True Pyrolysis 1_total	73%	52%
mid -d recycling, True Pyrolysis 1_total	74%	57%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, True Pyrolysis 1_total	Wet AD with biogas to grid injection	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		351.89	-0.32	2031	497.07	96.27	33.80
hi recycling, MHT 2, SRF to power_station_generic	Aerobic Digestion	hi	MHT 2	power_station_generic	36%	0%	-	55%	352.57	-0.43	2031	618.27	119.76	42.02
mid -f recycling, MHT 1, SRF to Gasification 1	Dry AD with electricity generation	mid -f	MHT 1	ATT_generic	30%	0%	-	61%	353.39	-0.32	2031	595.57	105.12	50.73
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	353.69	-0.33	2031	549.22	105.12	38.60
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -f	Dirty MRF 1	incineration_generic	30%	0%	-	58%	353.69	-0.33	2031	548.64	105.12	38.45
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	Dry AD with electricity generation	mid -d	MBT aerobic 4	ATT_generic	30%	0%	-	65%	354.32	-0.37	2031	553.40	96.27	48.54
lo recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	lo	MBT aerobic 3	power_station_generic	36%	0%	-	43%	354.96	-0.41	2031	578.19	109.48	41.81
hi recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	hi	Incineration 2 (low CHP)_total	#N/A	22%	10%	47%		355.46	-0.28	2031	602.00	119.76	37.77
hi recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	hi	Incineration 2 (low CHP)_total	#N/A	22%	10%	47%		355.46	-0.28	2031	601.07	119.76	37.52
NC recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	355.89	-0.36	2031	587.44	83.05	70.67
NC recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	357.70	-0.35	2031	588.54	83.05	70.96
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	lo	MBT aerobic 1	incineration_generic	30%	0%	-	43%	358.28	-0.28	2031	579.97	109.48	42.28
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	lo	MBT aerobic 1	incineration_generic	30%	0%	-	43%	358.28	-0.28	2031	579.28	109.48	42.10
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	Aerobic Digestion	hi	MBT AD 2 (SRF)	power_station_generic	36%	0%	-	54%	358.29	-0.44	2031	601.46	119.76	37.62
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	359.47	-0.32	2031	567.22	105.12	43.31
mid -d recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		359.53	-0.34	2031	519.75	96.27	39.73
lo recycling, Gasification Gas Engine 2_total	Wet AD with electricity generation	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		359.96	-0.31	2031	522.23	109.48	27.17
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	361.72	-0.33	2031	570.68	109.48	39.85
lo recycling, True Pyrolysis 1_total	Wet AD with electricity generation	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		362.13	-0.30	2031	548.83	109.48	34.13
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	362.17	-0.37	2031	555.70	109.48	35.93

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, True Pyrolysis 1_total	74%	57%
hi recycling, MHT 2, SRF to power_station_generic	83%	55%
mid -f recycling, MHT 1, SRF to Gasification 1	76%	61%
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	58%
mid -f recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	58%
mid -d recycling, MBT aerobic 4, SRF to Gasification 1	72%	65%
lo recycling, MBT aerobic 3, SRF to power_station_generic	70%	43%
hi recycling, Incineration 2 (low CHP)_total	80%	47%
hi recycling, Incineration 2 (low CHP)_total	80%	47%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	71%	43%
lo recycling, MBT aerobic 1, SRF to Incineration 1 (electricity only)	71%	43%
hi recycling, MBT AD 2 (SRF), SRF to power_station_generic	81%	54%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
lo recycling, Gasification Gas Engine 2_total	74%	57%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%
lo recycling, True Pyrolysis 1_total	74%	57%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
mid -d recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		363.38	-0.33	2031	521.86	96.27	40.28
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	363.91	-0.27	2031	544.89	83.05	59.53
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 3	ATT_generic	30%	0%	-	38%	365.24	-0.28	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MBT aerobic 3	ATT_generic	30%	0%	-	38%	365.24	-0.28	2031	567.18	105.12	43.30
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	365.36	-0.26	2031	545.99	83.05	59.82
mid -f recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		365.58	-0.27	2031	527.19	105.12	32.83
mid -f recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	mid -f	Gasification Gas Engine 1_total	#N/A	30%	0%	52%		365.58	-0.27	2031	526.60	105.12	32.68
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MHT 1	incineration_generic	30%	0%	-	55%	366.40	-0.34	2031	618.31	119.76	42.03
NC recycling, MBT aerobic 3, SRF to power_station_generic	Aerobic Digestion	NC	MBT aerobic 3	power_station_generic	36%	0%	-	50%	366.40	-0.35	2031	588.53	83.05	70.95
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	54%	367.14	-0.33	2031	601.50	119.76	37.63
mid -d recycling, Gasification Gas Engine 1_total	Wet AD with biogas to transport fuel	mid -d	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		367.23	-0.32	2031	484.30	96.27	30.45
mid -d recycling, Gasification Gas Engine 1_total	Wet AD with biogas to grid injection	mid -d	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		367.23	-0.32	2031	483.98	96.27	30.37
hi recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to transport fuel	hi	Incineration 1 (electricity only)_total	#N/A	30%	0%	47%		367.84	-0.28	2031	557.30	119.76	26.07
hi recycling, Incineration 1 (electricity only)_total	Wet AD with biogas to grid injection	hi	Incineration 1 (electricity only)_total	#N/A	30%	0%	47%		367.84	-0.28	2031	556.36	119.76	25.82
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	58%	367.96	-0.30	2031	571.03	105.12	44.30
mid -f recycling, MHT 2, SRF to Gasification 1	Aerobic Digestion	mid -f	MHT 2	ATT_generic	30%	0%	-	61%	368.33	-0.33	2031	595.55	105.12	50.72
lo recycling, Gasification Gas Engine 2_total	Dry AD with electricity generation	lo	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		368.75	-0.29	2031	526.78	109.48	28.36
lo recycling, MBT aerobic 4, SRF to Gasification 1	Aerobic Digestion	lo	MBT aerobic 4	ATT_generic	30%	0%	-	73%	370.45	-0.37	2031	606.67	109.48	49.26
lo recycling, True Pyrolysis 1_total	Dry AD with electricity generation	lo	True Pyrolysis 1_total	#N/A	32%	0%	57%		371.01	-0.28	2031	553.37	109.48	35.32
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	Aerobic Digestion	mid -d	MBT aerobic 4	power_station_generic	36%	0%	-	65%	371.82	-0.41	2031	553.39	96.27	48.53

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	69%	38%
mid -f recycling, MBT aerobic 3, SRF to Gasification 1	69%	38%
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
mid -f recycling, Gasification Gas Engine 1_total	73%	52%
mid -f recycling, Gasification Gas Engine 1_total	73%	52%
hi recycling, MHT 1, SRF to Incineration 1 (electricity only)	84%	55%
NC recycling, MBT aerobic 3, SRF to power_station_generic	38%	50%
hi recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	81%	54%
mid -d recycling, Gasification Gas Engine 1_total	74%	57%
mid -d recycling, Gasification Gas Engine 1_total	74%	57%
hi recycling, Incineration 1 (electricity only)_total	80%	47%
hi recycling, Incineration 1 (electricity only)_total	80%	47%
mid -f recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	73%	58%
mid -f recycling, MHT 2, SRF to Gasification 1	76%	61%
lo recycling, Gasification Gas Engine 2_total	74%	57%
lo recycling, MBT aerobic 4, SRF to Gasification 1	74%	73%
lo recycling, True Pyrolysis 1_total	74%	57%
mid -d recycling, MBT aerobic 4, SRF to power_station_generic	72%	65%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	NC	Dirty MRF 1	incineration_generic	30%	0%	-	69%	372.55	-0.26	2031	545.98	83.05	59.82
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	Dirty MRF 1	incineration_generic	30%	0%	-	63%	372.59	-0.35	2031	560.24	109.48	37.12
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MHT 2	incineration_generic	30%	0%	-	64%	372.66	-0.34	2031	607.11	109.48	49.38
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	372.74	-0.38	2031	551.30	96.27	47.99
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	lo	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	55%	373.44	-0.31	2031	575.22	109.48	41.04
mid -f recycling, Gasification 1_total	Wet AD with biogas to transport fuel	mid -f	Gasification 1_total	#N/A	30%	0%	52%		373.66	-0.27	2031	449.28	105.12	12.45
mid -f recycling, Gasification 1_total	Wet AD with biogas to grid injection	mid -f	Gasification 1_total	#N/A	30%	0%	52%		373.66	-0.27	2031	448.70	105.12	12.29
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	375.12	-0.33	2031	591.76	105.12	49.73
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to transport fuel	mid -d	Dirty MRF 1	incineration_generic	30%	0%	-	61%	375.82	-0.35	2031	507.85	96.27	36.62
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	Wet AD with biogas to grid injection	mid -d	Dirty MRF 1	incineration_generic	30%	0%	-	61%	375.82	-0.35	2031	507.53	96.27	36.53
mid -d recycling, Gasification 1_total	Wet AD with biogas to transport fuel	mid -d	Gasification 1_total	#N/A	30%	0%	57%		376.18	-0.32	2031	409.06	96.27	10.76
mid -d recycling, Gasification 1_total	Wet AD with biogas to grid injection	mid -d	Gasification 1_total	#N/A	30%	0%	57%		376.18	-0.32	2031	408.74	96.27	10.68
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	Aerobic Digestion	mid -f	MBT AD 2 (SRF)	ATT_generic	30%	0%	-	58%	377.32	-0.32	2031	571.00	105.12	44.30
lo recycling, Gasification Gas Engine 1_total	Wet AD with electricity generation	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		378.40	-0.31	2031	535.82	109.48	30.73
hi recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	378.77	-0.44	2031	594.56	119.76	35.82
lo recycling, Incineration 3 (medium CHP)_total	Aerobic Digestion	lo	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		379.65	-0.30	2031	578.46	109.48	41.88
mid -f recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		380.06	-0.31	2031	561.61	105.12	41.84
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	380.12	-0.36	2031	590.64	119.76	34.79
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	Aerobic Digestion	mid -d	MHT 1	incineration_generic	30%	0%	-	70%	380.30	-0.35	2031	549.87	96.27	47.61
mid -d recycling, Incineration 3 (medium CHP)_total	Aerobic Digestion	mid -d	Incineration 3 (medium CHP)_total	#N/A	20%	20%	57%		383.03	-0.33	2031	521.84	96.27	40.28

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
NC recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	50%	69%
lo recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	76%	63%
lo recycling, MHT 2, SRF to Incineration 1 (electricity only)	77%	64%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
lo recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	72%	55%
mid -f recycling, Gasification 1_total	73%	52%
mid -f recycling, Gasification 1_total	73%	52%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	61%
mid -d recycling, Dirty MRF 1, SRF to Incineration 1 (electricity only)	75%	61%
mid -d recycling, Gasification 1_total	74%	57%
mid -d recycling, Gasification 1_total	74%	57%
mid -f recycling, MBT AD 2 (SRF), SRF to Gasification 1	73%	58%
lo recycling, Gasification Gas Engine 1_total	74%	57%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
lo recycling, Incineration 3 (medium CHP)_total	74%	57%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
mid -d recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	70%
mid -d recycling, Incineration 3 (medium CHP)_total	74%	57%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	Aerobic Digestion	lo	MBT AD 2 (SRF)	incineration_generic	30%	0%	-	62%	383.39	-0.32	2031	583.15	109.48	43.11
lo recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with electricity generation	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	384.71	-0.41	2031	573.64	109.48	40.62
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	mid -d	MBT aerobic 1	power_station_generic	36%	0%	-	40%	385.67	-0.38	2031	519.91	96.27	39.77
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	mid -d	MBT aerobic 1	power_station_generic	36%	0%	-	40%	385.67	-0.38	2031	519.59	96.27	39.69
mid -f recycling, Incineration 3 (medium CHP)_total	Dry AD with electricity generation	mid -f	Incineration 3 (medium CHP)_total	#N/A	20%	20%	52%		385.80	-0.29	2031	565.43	105.12	42.84
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Wet AD with electricity generation	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	385.84	-0.35	2031	514.12	96.27	38.26
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	386.95	-0.37	2031	504.93	96.27	35.85
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	387.18	-0.36	2031	543.92	105.12	37.21
lo recycling, Gasification Gas Engine 1_total	Dry AD with electricity generation	lo	Gasification Gas Engine 1_total	#N/A	30%	0%	57%		387.64	-0.29	2031	540.37	109.48	31.92
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -f	MHT 1	incineration_generic	30%	0%	-	61%	387.85	-0.31	2031	595.57	105.12	50.73
lo recycling, Gasification 1_total	Wet AD with electricity generation	lo	Gasification 1_total	#N/A	30%	0%	57%		387.95	-0.30	2031	461.08	109.48	11.17
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT aerobic 4	incineration_generic	30%	0%	-	65%	388.48	-0.37	2031	553.40	96.27	48.54
NC recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to transport fuel	NC	MBT aerobic 1	power_station_generic	36%	0%	-	50%	388.71	-0.31	2031	588.97	83.05	71.07
NC recycling, MBT aerobic 1, SRF to power_station_generic	Wet AD with biogas to grid injection	NC	MBT aerobic 1	power_station_generic	36%	0%	-	50%	388.71	-0.31	2031	588.80	83.05	71.02
mid -d recycling, Gasification Gas Engine 2_total	Wet AD with electricity generation	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		390.75	-0.34	2031	467.70	96.27	26.11
hi recycling, Incineration 3 (medium CHP)_total	Wet AD with electricity generation	hi	Incineration 3 (medium CHP)_total	#N/A	20%	20%	47%		390.85	-0.34	2031	591.50	119.76	35.02
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	mid -d	Dirty MRF 1	ATT_generic	30%	0%	-	61%	392.40	-0.36	2031	507.03	96.27	36.40
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	mid -d	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	56%	393.02	-0.34	2031	516.22	96.27	38.81
mid -d recycling, True Pyrolysis 1_total	Wet AD with electricity generation	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		393.41	-0.33	2031	494.47	96.27	33.11
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	Wet AD with electricity generation	mid -f	MBT aerobic 3	power_station_generic	36%	0%	-	38%	393.58	-0.42	2031	562.45	105.12	42.06

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, MBT AD 2 (SRF), SRF to Incineration 1 (electricity only)	74%	62%
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	69%	40%
mid -d recycling, MBT aerobic 1, SRF to power_station_generic	69%	40%
mid -f recycling, Incineration 3 (medium CHP)_total	73%	52%
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
lo recycling, Gasification Gas Engine 1_total	74%	57%
mid -f recycling, MHT 1, SRF to Incineration 1 (electricity only)	76%	61%
lo recycling, Gasification 1_total	74%	57%
mid -d recycling, MBT aerobic 4, SRF to Incineration 1 (electricity only)	72%	65%
NC recycling, MBT aerobic 1, SRF to power_station_generic	38%	50%
NC recycling, MBT aerobic 1, SRF to power_station_generic	38%	50%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
hi recycling, Incineration 3 (medium CHP)_total	80%	47%
mid -d recycling, Dirty MRF 1, SRF to Gasification 1	75%	61%
mid -d recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	71%	56%
mid -d recycling, True Pyrolysis 1_total	74%	57%
mid -f recycling, MBT aerobic 3, SRF to power_station_generic	68%	38%

APPENDIX E – SCENARIO OUTPUTS - SCENARIOS MEETING THE EPS LEVEL IN 2031 AND THE CARBON INTENSITY FLOOR, RANKED BY CARBON INTENSITY FLOOR PERFORMANCE

Table 1: Carbon Intensity 'Floor' Requirements Data

Option	AD option	Recycling option	Primary Technology	Secondary (Thermal) Treatment	Assumed gross generation efficiency (%)		Calorific Value (CV) from biomass (%)		Carbon Intensity Floor Performance (energy) (gCO2e/kWh)	EPS		Costs		
					Electricity	Heat	Untreated waste	Treated waste (SRF)		EPS (mass) (tCO2e/tonne)	EPS level achieved up to	Total CAPEX+OPEX (inc collection costs) (£M)	Collection (£/t)	Disposal (£/t)
lo recycling, Gasification 2_total	Wet AD with biogas to transport fuel	lo	Gasification 2_total	#N/A	21%	0%	57%		393.60	-0.25	2031	560.29	109.48	37.13
lo recycling, Gasification 2_total	Wet AD with biogas to grid injection	lo	Gasification 2_total	#N/A	21%	0%	57%		393.60	-0.25	2031	559.60	109.48	36.95
lo recycling, MHT 1, SRF to Gasification 1	Aerobic Digestion	lo	MHT 1	ATT_generic	30%	0%	-	64%	393.91	-0.34	2031	607.11	109.48	49.38
hi recycling, MBT aerobic 3, SRF to power_station_generic	Dry AD with electricity generation	hi	MBT aerobic 3	power_station_generic	36%	0%	-	33%	394.78	-0.41	2031	600.70	119.76	37.43
lo recycling, Dirty MRF 1, SRF to Gasification 1	Aerobic Digestion	lo	Dirty MRF 1	ATT_generic	30%	0%	-	63%	395.13	-0.36	2031	560.21	109.48	37.11
mid -f recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		395.17	-0.26	2031	569.62	105.12	43.94
mid -f recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	mid -f	Incineration 2 (low CHP)_total	#N/A	22%	10%	52%		395.17	-0.26	2031	569.04	105.12	43.78
mid -d recycling, Gasification Gas Engine 2_total	Dry AD with electricity generation	mid -d	Gasification Gas Engine 2_total	#N/A	32%	0%	57%		395.41	-0.33	2031	469.80	96.27	26.66
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	Dry AD with electricity generation	mid -f	Dirty MRF 1	ATT_generic	30%	0%	-	58%	395.52	-0.34	2031	547.73	105.12	38.21
mid -d recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to transport fuel	mid -d	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		395.96	-0.31	2031	525.29	96.27	41.18
mid -d recycling, Incineration 2 (low CHP)_total	Wet AD with biogas to grid injection	mid -d	Incineration 2 (low CHP)_total	#N/A	22%	10%	57%		395.96	-0.31	2031	524.97	96.27	41.10
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	Dry AD with electricity generation	hi	MBT AD 1 (landfill)	incineration_generic	30%	0%	-	47%	397.09	-0.33	2031	596.78	119.76	36.40
hi recycling, Dirty MRF 1, SRF to Gasification 1	Wet AD with electricity generation	hi	Dirty MRF 1	ATT_generic	30%	0%	-	52%	397.20	-0.38	2031	578.08	119.76	31.51
lo recycling, Gasification 1_total	Dry AD with electricity generation	lo	Gasification 1_total	#N/A	30%	0%	57%		397.43	-0.28	2031	465.62	109.48	12.36
lo recycling, MBT aerobic 1, SRF to power_station_generic	Dry AD with electricity generation	lo	MBT aerobic 1	power_station_generic	36%	0%	-	43%	397.93	-0.38	2031	578.19	109.48	41.81
mid -d recycling, True Pyrolysis 1_total	Dry AD with electricity generation	mid -d	True Pyrolysis 1_total	#N/A	32%	0%	57%		398.13	-0.32	2031	496.57	96.27	33.66
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to transport fuel	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	398.36	-0.27	2031	567.76	105.12	43.45
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	Wet AD with biogas to grid injection	mid -f	MBT aerobic 1	ATT_generic	30%	0%	-	38%	398.36	-0.27	2031	567.18	105.12	43.30

Table 2: Biomass within Residual Waste Streams

Option name	Fraction of municipal waste recycled (including residual treatment outputs)	CV from biomass of residual waste (%)
lo recycling, Gasification 2_total	74%	57%
lo recycling, Gasification 2_total	74%	57%
lo recycling, MHT 1, SRF to Gasification 1	77%	64%
hi recycling, MBT aerobic 3, SRF to power_station_generic	78%	33%
lo recycling, Dirty MRF 1, SRF to Gasification 1	76%	63%
mid -f recycling, Incineration 2 (low CHP)_total	73%	52%
mid -f recycling, Incineration 2 (low CHP)_total	73%	52%
mid -d recycling, Gasification Gas Engine 2_total	74%	57%
mid -f recycling, Dirty MRF 1, SRF to Gasification 1	75%	58%
mid -d recycling, Incineration 2 (low CHP)_total	74%	57%
mid -d recycling, Incineration 2 (low CHP)_total	74%	57%
hi recycling, MBT AD 1 (landfill), SRF to Incineration 1 (electricity only)	79%	47%
hi recycling, Dirty MRF 1, SRF to Gasification 1	82%	52%
lo recycling, Gasification 1_total	74%	57%
lo recycling, MBT aerobic 1, SRF to power_station_generic	70%	43%
mid -d recycling, True Pyrolysis 1_total	74%	57%
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	69%	38%
mid -f recycling, MBT aerobic 1, SRF to Gasification 1	69%	38%

APPENDIX F – EXAMPLE CHP SCHEMES

F1: UK Schemes

Nottingham

Nottingham's community heating system was first established during the 1960's and serves houses, flats, offices, two major city centre shopping developments, a leisure centre and other industrial and commercial premises. The two main heat sources for the scheme are:

- fossil fuelled power station with a steam turbine generator, and
- Incineration facility consuming some 147kt/a of domestic waste.

The development of the community heating scheme is a cooperative arrangement between public and private sector organisations. The scheme is operated by EnviroEnergy (Nottingham) Limited through a local government and private sector partnership between Nottingham City Council and Dalkia Energy plc. The scheme can generate up to $10MW_e$ of electricity and supply up to $50MW_{th}$ of heat is supplied to commercial customers including Nottingham Trent University, the Victoria Centre shopping centre and the Inland Revenue building.

Energy efficiency figures submitted by WRG as part of a planning application indicate the following energy efficiencies[30]

		Efficiency
Waste Throughput (tpa)	154,069	
Waste typical CV (MJ/kg)	9.5	
Total heat supply (GWh)	406.5	
Gross power generation (GWh)	65.2	16%
Net power exported (GWh)	46.4	11.4%
Available Heat export (GWh)	143.3	35.2%
Net plant efficiency (max)	189.7	46.6%
Actual heat export in 2007 (GWh)	94.845	23.3%
Net plant efficiency (actual)	141.2	34.7%

Sheffield

During the 1980's, Sheffield City Council decided to explore a city-wide community heating scheme and formed an independent company (Sheffield Heat and Power – SHP) to own, operate and finance the CH network. The primary heat source for the CH system was the city's Incineration plant.

The CHP plant was replaced with a new plant with a MSW capacity of 225kt/yr, 20MWe/32MWth plant at the end of 2005.

Over 3,500 homes have now been connected to the heating system, designed to heat all habitable rooms to 21°C. Tenants pay a weekly standing charge with their rent to cover part

30 http://nottfoe.gn.apc.org/wrg10.pdf

of the costs of heat, with the remainder being paid for on the basis of usage, via prepayment cards inserted into a heat meter (metering based on actual use rather than apportioning meters). These cards are bought from local outlets such as shops and post offices. In addition all of the largest commercial and institutional consumers of heat in the city centre have also been connected onto the scheme.

Grimsby[31]

Located near Grimsby, at Stallingborough in North East Lincolnshire, the site is operated by Newlincs Developments Lid, a subsidiary of Cyclerval-UK which is a wholly owned subsidiary of the French-based Tiru Group.

Operated on a 25-year contract for North East Lincolnshire Council, the facility has been designed to process around 56k/a household waste from the local community, providing 3MW electricity and 3MW hot water to an adjacent industrial facility.

The overall energy use equates to a system energy efficiency of 31%.

Shetland

Shetland Heat Energy and Power Ltd[32] has been serving district heating to both domestic and non domestic properties in Lerwick since 1998. The heat used in the scheme is generated at a Energy from waste Incinerator located on the outskirts of Lerwick with heat distributed through a network of pre-insulated pipes stretching over 30km and supplying in the region of 1,000 customers.

In addition to the Energy from waste Plant, the Lerwick scheme has an oil-fired Peak Load Boiler Station to assist with meeting instantaneous peak demands, typically in the morning and tea-time, and also to maintain the supply during periods of downtime for maintenance and servicing of the WTE. The boiler station has 3 oil-fired boilers, providing a back-up of 15 MW in order to maintain and provide security of supply during periods of WTE downtime. This down time period is limited to 40days/a, spread across a two main shutdowns in the Spring and Autumn.

System tariffs for domestic properties are as follows (effective 01 October 2011)

- Basic Charge: 5p per kWh;
- Annual Standing Charge: £100;
- Connection Fee: £605.

SELCHP

South East London Combined Heat and Power (SELCHP) is a 31MWe (net) Incineration plant located in South East London. Originally planned to provide heat for local community heating schemes, the community heating arrangements were never realised. The plant remains a power-only scheme processing 420kt/a municipal waste.

The steam turbine has tapping arrangements to allow retrofit of community heating heat exchangers. However to date the economics have failed to justify an investment in community heating infrastructure.

31 http://www.newlincs.com/b_news_010805.htm
32 http://www.sheap-ltd.co.uk/

Slough Heat and Power

Slough Heat and Power is a 50MWe/20MWth CHP power station based on Slough Trading Estate that utilises biomass fuel in the form of woodchips to generate electricity which is distributed to the National Grid and heat which is utilised on the Trading Estate via a steam and hot water distribution network. The power station dates back to the 1920's and operated on coal until 2000.

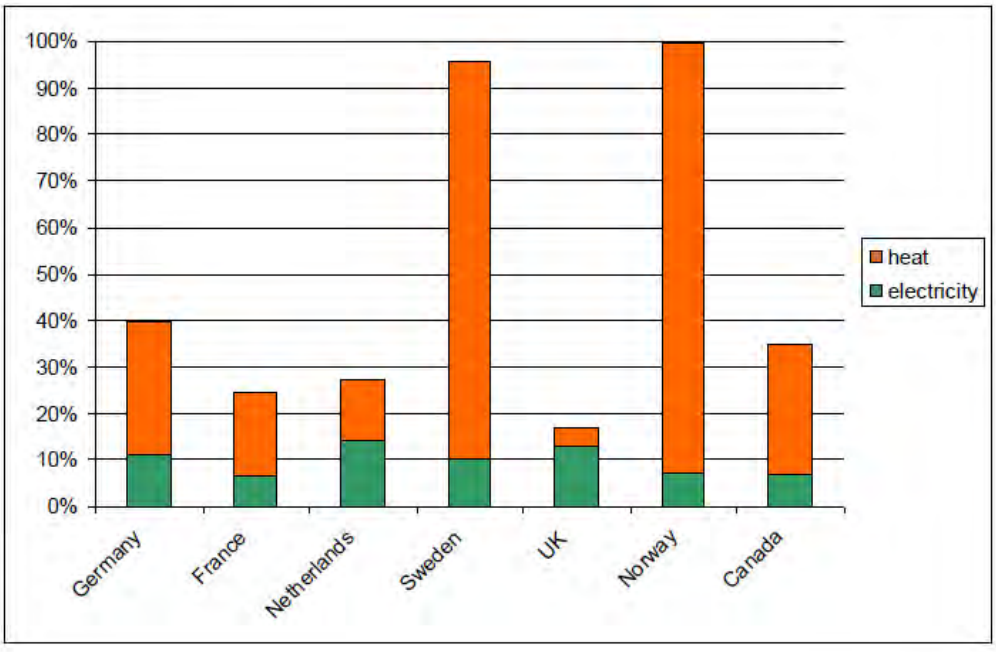
Since 2002 the plant has had the capability of processing biomass wastes through its two fluidised bed boilers. The plant also accepts a product called "fibre fuel" (100,000 tpa) produced from non-recyclable card and paper.

With a 50MWe generation capacity the plant processes upwards of 500ktpa of waste derived fuels. An input of 500 ktpa is equivalent to 173 MWth suggesting an energy efficiency in the region of 40% (50MWe + 20MWth/173 MWth)

F2: European Examples

The situation in Europe is that a vast majority of plants are CHP enabled and in many countries heat is the major form of energy use as depicted in Figure F1.

Figure F1: Energy recovery from waste incineration as a percentage of the heat content of the input



33

Germany

The majority of the 67 Incineration plants in Germany operate as CHP, providing heat to existing large municipal heating networks.

33 IEA Bioenergy Accomplishments from IEA Bioenergy. Task 36: Integrating Energy Recovery into Solid Waste Management Systems (2007-2009) End of Task Summary Report

Recently constructed Incineration plants have tended to be installed as heat-only facilities, as power generation is less attractive, due to the price regulation of direct supply and poor off-take prices being offered by the larger power companies.

Switzerland

There are 28 Incineration plants in Switzerland, of which 22 are CHP plants. Those without heat off-take tend to be in rural regions where population density is low and there is an absence of large heat consumers.

CHP in conjunction with Incineration in Switzerland is well established. As in Germany, the older plants tend to be located in cities where they are connected to large community heating networks that have an extensive heat demand. The cities (Basel, Bern, Zurich, Lausanne, Geneva, Winterthur) have large distribution networks that supply both industrial and household customers. Most of the networks pre-date the Incineration plants.

Newer plants only deliver heat to industry and other large consumers due to economic constraints for establishing new CH networks.

All Incineration plants in Switzerland are owned and operated either by state owned companies or the municipalities with the majority of community heating systems connected to Incineration plants being owned and operated by the same authority.

F3: Examples of Non-Waste CHP

Whitehall District Heating System

The Whitehall District Heating System provides heat to 23 Government office buildings in Whitehall, amounting to 270,000m^2 of floor space via an underground network of pipes, totalling 24km in length. Electricity is generated by a gas turbine based unit producing 4.7MW electricity and 9MW heat. Normal fuel is natural gas, with the ability to run on oil during supply interruptions. The building uses only 400kW of the electricity generated; the 4.3MW balance is exported to the local electricity supplier London Energy.

Pimlico and Whitehall Decentralised Energy project[34]

The Pimlico and Whitehall Decentralised Energy project will interconnect and improve two existing district heating systems allowing for further expansion of low-carbon heat networks in Westminster. The project involves installing district heating pipe work between the Whitehall and Pimlico district heating schemes in order to improve the operational efficiency of the existing CHP plants.

The Pimlico scheme has an installed CHP capacity of 3.4MWth and 3.1MWe, supplying over 3,000 residential and 50 commercial customers.

34 http://www.lda.gov.uk/projects/pimlico-whitehall-decentralised-energy/index.aspx

Steering Group Responses – Emissions Performance Standard (EPS), Financial and Technical Implications Report

The table below lists the responses from the EPS Steering Group to SLR's Progress Report on the financial and technical implications for meeting the Mayor's proposed EPS for municipal waste activities. The responses were received between 7 and 16 March 2011. The table also sets out how the issues raised by the Steering Group has been or will be addressed in SLR's final report

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
01	Fiona Heyland, Tower Hamlets	Question 1, general	This appears to focus almost solely on the carbon intensity floor. Whilst I accept that this element of the proposed EPS has caused concern during the consultation process, the potential cost to local authorities to achieve the main part of the EPS is also a very real issue and so far is almost totally glossed over in the Progress Report.		The model is intended to cover the cost of meeting both the EPS and the carbon floor. Each scenario modelled will include the environmental and financial impacts of collection and treatment of wastes. Final report will ensure this is clear
			It was my assumption that the additional work being carried out will look at costing the options to achieve the recycling rates and CO2 reduction rates that have been determined in the main part of the EPS. Can you		The options used to achieve recycling rates and to set the EPS were costed by Eunomia. Refer

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
			confirm this will be part of the additional work? The report refers to " a range of waste collection and treatment scenarios" that will be appraised. Have they been chosen yet? Is the choice dependant on you being able to access suitable data? So far the report only seems to focus on data related to treatment technologies. SLR to clarify in final report. Scenarios need to be set out/summarised The report refers to the fact that the results of the options analysis will be compared to "the carbon floor today and the DECC approved grid emission factor projections". Where can I find those grid projections (are they in WRATE?) so that I can see the differential between the grid projections and the carbon intensity of the previously proposed displaced energy source (CCGT)?		Chapter 3, Pg 93 Policy 2 of the Mayor's draft MWS. The additional work undertaken by SLR looks at costing a more extensive range of waste management options for meeting the EPS The carbon floor level has been amended to 400gCO2/kwh in line with the latest DECC guidance on the marginal source of electricity. See pg 9 http://www.decc.gov.uk/assets/decc/statistics/analysis_group/1_20100125163218_e_@@_valuationenergyuseggemissionsbackground.pdf

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
					DECC grid mix factors (in the final report) used for the DECC Low Carbon Transition Plan 2009: http://www.decc.gov.uk/assets/decc/White%20Papers/UK%20Low%20Carbon%20Transition%20Plan%20WP09/1_20090724153238_e_@@_lowcarbontransitionplan.pdf Actual figures provided by DECC correspondence to GLA: **2015** - 434g CO2 per kWh electricity generated **2020** – 381g CO2 per kWh electricity generated **2025 - 2031** - 315g CO2 per kWh electricity generated (No figures have been

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
					set after 2025)
02	Fiona Heyland, Tower Hamlets	Question 2, page 18, page 19	LBTH may be able to provide some collection cost information but I can't get it to you by 14th March. Can we have an extended deadline for this? Looking at the collection costs per tonne that you show in the table related to Step 4 on page 18, the food waste cost is 4 times lower than it actually costs LBTH to collect food waste. I don't understand the gate fee figures shown in the top table on page 19. Why for example is -11 used for dry recyclables?		Data has since been received Data has been provided by Lambeth Council for food collection costs. The negative costs relate to income derived from sale of recyclates. The final model uses a blended rate which includes the cost of collection and income from recyclables
03	Fiona Heyland, Tower Hamlets	Question 3, general	Providing Gate Fee prices may be difficult as all of mine are covered by confidentiality clauses. I can give you an indication of where my gate fees sit in relation to the WRAP figures: MRF - much lower than the Median figure IVC Composting - much higher than the Median figure		Gate fee data has been sourced from 3 different sources; WRAP, SLR, and West London

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
			Landfill Gate Fee only - very similar to Median figure but we have a lot of transport and handling costs on top as well as landfill tax.		Waste authority. Your observations on actual costs in relation to assumed figure are helpful in understanding the wider London situation. The model will however need to be based on referenced figures
04	Fiona Heyland, Tower Hamlets	Question 4, general	There are two technology providers in the gasification/pyrolysis category that are not listed in your report. Advanced Plasma Power and EPi. I don't have data on the technologies that I am in a position to pass on (again covered by a confidentiality agreement) but the technologies may well feature in new facilities in London in the future. I am not in a position to comment on other technical content as I am not an engineer My real worry at present is that the main bulk of the audience of the EPS (and those that will be tasked with trying to find ways to achieve it) would currently have difficulty understanding it and the implications of it. I		APP have been included in the review. EPI were invited to submit data however due to current workloads have been unable to do so The Mayor's Municipal Waste Strategy will clearly set out the EPS

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
			would want to make sure that the additional work that is done helps to overcome these key issues. I feel like I have not been much help so far, this is probably because I am only half way through doing my own WRATE modelling and yet to determine what LBTH's current emissions performance is. I am hoping to be more enlightened shortly		and how it will be implemented. The final SLR report will clearly outline the most affordable solutions for meeting the EPS and draw links to the carbon calculator work undertaken by SLR.
05	Jim Brennan, West London Waste	Question 1, general	The general approach seems reasonable and robust		
06	Jim Brennan, West London Waste	Question 2, general	As a WDA we don't have access to collection costs.		Accepted
07	Jim Brennan, West London Waste	Question 3, general	I've pasted below the Authority's Pay as You Throw rates for 2011/12. These are the rates that the Authority charge the boroughs for the disposal service that they require. They are not gate fees, as they represent averaged costs where n more than one provider is used. They include for some transport costs, (which are dependent upon the location of the plant), but do not include any Transfer Station operating costs or Authority overheads. This data was reported to the Authority's January meeting on the		Thank you, these will be compared against other data sources

<table>
<tr><th>Consultation response number</th><th>Respondee name and organisation</th><th>Document reference (general, section X.X, page etc)</th><th>Consultation response</th><th>Cross over with other response (input consultation response numbers here)</th><th>SLR / GLA action</th></tr>
<tr><td></td><td></td><td></td><td>public agenda. I suggest that it will be most useful to you as a London comparator against your own data.
<table><tr><td>Waste Treatment Method</td><td>PAYT Rate 2011-12

(£ per tonne)</td></tr><tr><td>Waste to Landfill</td><td>85.05</td></tr><tr><td>Energy from Waste</td><td>97.34</td></tr><tr><td>Dirty MRF (including transport)</td><td>86.00</td></tr><tr><td>Windrow Composting</td><td>35.93</td></tr><tr><td>In-Vessel Composting</td><td>36.15</td></tr><tr><td>Anaerobic Digestion</td><td>60.37</td></tr><tr><td>Abandoned Vehicles (per vehicle)</td><td>38.00</td></tr><tr><td>LATS Purchase / Sale</td><td>Determined by

market</td></tr></table></td><td></td><td></td></tr>
<tr><td>08</td><td>Jim Brennan,</td><td>Question 4, general</td><td>I don’t think there are any obvious omissions from</td><td></td><td></td></tr>
</table>

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
	West London Waste		your technology list		
09	Jim Brennan, West London Waste	Question 5, general	My concern is that the presentation of the final report needs careful consideration. At present it isn't very user friendly. I think you need to take some example process changes from current or proposed London systems and demonstrate their compliance with the proposed EPS, and then add a range of future scenarios, probably based on the Mayors modelled scenarios and demonstrate their compliance and cost per tonne.		The model looks at a wide range of scenarios based on combinations of source segregated collection schemes, waste pretreatment and energy recovery recording the overall cost and performance against the EPS and the carbon floor. In addition to developing overall scheme costs the report examines the costs of process changes such as converting an electricity only EFW to CHP.
10	Ash Mark, East	Question 1, section	The general approach and methodology appears to be		The Economic

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
	London Waste Authority	2.1	sound to deliver the outcomes required. However, unless the specification has changed, the objective in 2.1 of the specification is outlined as "to identify options for how London waste authorities could meet the carbon intensity floor…..and to financially and technically appraise these options". Given that the vast majority of London's collection and disposal authorities have or soon will have long term contracts in place for collection and/or disposal will the report consider whether or not the targets set in the strategy will realistically be met within the timescales laid down? Also will the report consider the timescales required to deliver additional infrastructure in London and the creation of markets / end users for SRF or heat offtake for example which are required for the targets to be met?		Modelling Report used to develop the strategy and set the EPS (done by Eunomia) costed 10 scenarios on a London-wide level comprising waste services and infrastructure requirements to meet the Mayor's targets by 2031. The SLR report costs a more substantial 950 waste scenarios to meet the EPS. The GLA will work with boroughs (through contract negotiations and waste service improvements) and LWARB to help drive market

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
					appetite/deliver the infrastructure required.
11	Ash Mark, East London Waste Authority	Question 2, general	Unfortunately I do not have any collection costs data available to me as the WDA. Would another organisation such as iese hold such data?		See Consultation response number 9 comments above
12	Ash Mark, East London Waste Authority	Question 3, general	All of our waste is contracted to Shanks under a 25 year PFI contract so we don't have a gate fee as such. Our unitary fee per tonne includes provision of RRC sites, infrastructure costs etc so would not be of much use to you.		
13	Ash Mark, East London Waste Authority	Question 4, section 2.1	I do not know of any existing relevant waste technologies that are missing from your list in section 2.1.		
14	Ash Mark, East London Waste Authority	Question 5, general	My only other comments are to support the comments already made by colleagues in that the final report should be as simplistic as possible so that non technical officers will be able to grasp the outcomes perhaps supported by worked scenarios that can be easily related to.		Final report will be clearly set out affordable solutions for meeting the EPS
15	Jacob Hayler, Environmental	General	Lifecycle analyses of waste management systems are hugely complex and vary from project to project		For consistency we are bound by

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
	Services Association		ESA's Members have ongoing concerns about the inappropriate use of WRATE. WRATE is an important tool but it must be clear to all stakeholders that waste management projects are bespoke and the emissions implications arising from them are variable and complex. The application of generic assumptions in any life-cycle analysis may not pick up the particular circumstances which apply to any specific project. The inappropriate use of WRATE refers to: - Comparing individual facilities rather than looking at an integrated waste scheme; - Modelling guaranteed emission levels in WRATE which are worst-case scenario, and comparing to landfill. For example, the landfill gas capture rate should be altered to be 'worst case' in order for this to be a fair comparison; and - Not all waste treatment technologies are portrayed realistically. WRATE is an important tool decision making tool, and should remain the standard tool for the comparison of options at a high level. However, it is not designed to compare individual facilities or count the last tonne of carbon. The EPE protocol, developed in France and adopted by ESA for its greenhouse gas reporting, is more appropriate for establishing the EPS because it *is* suited to counting the last tonne of carbon.		WRATE methodology. The EPS will be reviewed and monitored on an annual basis to take account of any WRATE updates. ARUP in their peer review of the methodology used to develop the EPS concluded the approach to be sound and provided recommendations (including improvements consistent with the EPE protocol) that have been incorporated into the EPS for final adoption.

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
			ESA's Members also note that there appears to be no measure of the treatment route which has been displaced by the development of a new facility. In most cases this will be landfill and a project's carbon performance should be compared to this baseline.		All non-landfill waste management technologies divert waste away from landfill. Regardless of the technology the avoided burdens associated with landfill avoidance would be common across all scenarios. This benefit is considerably greater than the additional benefits achieved by different waste recovery methods. For example the benefit of converting from Electricity Only to CHP enabled may only be 20% of the

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
					benefit of landfill avoidance. The GLA is looking to maximise the carbon benefit of waste management. In including a large constant factor in all scenarios there is a danger that the marginal benefits of different technical approaches become overlooked. Furthermore, it may be argued that the diversion of biodegradable waste away from landfill is a statutory requirement governed by EU

Consultation response number	Respondee name and organisation	Document reference (general, section X.X, page etc)	Consultation response	Cross over with other response (input consultation response numbers here)	SLR / GLA action
					and national statute. On this basis waste has to be diverted from landfill and therefore the baseline of landfill is not a true baseline as landfill cannot be a viable option.
16	Jacob Hayler, Environmental Services Association	general	<u>Any carbon metrics developed in London must be consistent with initiatives in other parts of the UK</u> It is vitally important that any carbon metrics introduced in London are based on transparent assumptions and are consistent with metrics developed elsewhere in the UK. Both the Scottish Government and the Wales Assembly Government are developing different carbon metrics for waste. The underlying assumptions should be consistent between schemes.		Consistency with WRATE is a requirement. The model can be updated on an ongoing basis with more uptodate figures if required As a result of the peer review, the EPS has been updated to align with other carbon accounting

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					approaches including the Scottish Carbon Metric and EPE Protocol
17	Jacob Hayler, Environmental Services Association	Section 4.2, step 6, page 19, sheet 8	<u>It is imperative that a whole system is approach and that facilities are not judged in isolation</u> It is confusing as to what the CCGT-related EPS applies. The previous Eunomia report (August 2010) which examined this issue calculated a separate EPS for six "whole waste system" scenarios, including energy generation, as well as a separate EPS for energy generating plants alone. The table under section 4.2 appears to apply the EPS to energy-only operations. Whole waste system carbon outputs are calculated under Step 6 on page 19, but it is unclear whether the EPS is then subsequently applied. This is important to clarify because the whole-system carbon outputs are so dominated by avoided emissions due to recycling (step 6, page 19) that from a waste management point of view, the impact of energy recovery is marginal, especially given the high recycling targets proposed for London.		The CCGT-related EPS (carbon intensity floor) only applies to energy generated from municipal waste and sits within the whole system EPS. The carbon intensity floor has been set to align the Mayor's climate change mitigation and decentralised energy goals with his waste management goals. SLR's final report will cost scenarios that meet both the

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					EPS and carbon intensity floor. The Mayor's municipal waste management strategy will clearly set out the relationship between meeting the EPS and the carbon intensity floor
			From a whole system perspective, it would appear to be far simpler to define the recycling levels required to meet the EPS to within a range of e.g. 10% (Sheet 8 more or less does that). These recycling levels should then be applied as a target on boroughs and businesses. This would be a far simpler approach than the complex EPS calculation process.		Meeting the EPS depends on what materials you focus on. Achieving higher recycling rates are likely to achieve the EPS but lower recycling rates that recover high proportions of carbon-rich materials like textiles and plastics

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					will also perform well. This provides flexibility over prescribing collection methods, waste services and technologies.
18	Jacob Hayler, Environmental Services Association	General	<u>Transport emissions must be included in the analysis, otherwise the approach will be biased against facilities which require fewer pre-treatment steps</u> It is vital that all emissions from waste processes are included in the analysis, including those for transport. The exclusion of transport emissions penalises facilities which do not require intermediate pre-processing and associated additional transportation.		The costs of collection are included within the model. Emissions from transport are now included in the EPS as a result of the EPS peer review.
			ESA's Members also have concerns that the		The EPS provides a

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			introduction of the EPS may lead to some perverse outcomes. For example, waste may have to be pre-treated to raise its calorific value such that the standard could be met. This would also require additional transportation and any such emissions should be included in the analysis.		flexible approach supporting waste activities achieving the greatest climate change mitigation benefits. See comments above re transport emissions now being included in the EPS
19	Jacob Hayler, Environmental Services Association	General	<u>It would be logically more appropriate for the comparator technology to be coal-fired power or the UK grid average</u> ESA's Members believe that the comparator technology of CCGT is inappropriate. Efw is a base-load technology which needs to operate close to full capacity, similar to coal-fired power stations. CCGT however is a marginal generation option. It is a far more likely scenario that efw would replace coal-fired generation in the UK's electricity mix. This is also true due to the fact that the more polluting coal-fired generation is likely to be prioritised for replacement. ESA also notes that, according to page 13 of the draft publication, where biogas is used to generate electricity the offset will be based on the grid average.		Defra guidance (June 2010) confirmed CCGT is most likely to be displaced by waste to energy facilities and have therefore recommended CCGT to be the marginal source of energy generation until at least 2025. ARUP's methodological review of the EPS

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			This is inconsistent as it means that Anaerobic Digestion output can be compared to the grid average but not efw output. Based on the above, ESA believes that the comparator technology should be either coal-fired generation or the UK electricity grid average.		also concluded it suitable that the marginal source based on Defra Guidabce should be used to set the Carbon Intensity Floor (CIF).
			It is also unclear as to whether it is felt that efw would need to operate in CHP mode as the only way to match CCGT efficiency levels. If this was the case then the proposed EPS, if applied as a planning condition, might force all efw facilities to operate in CHP mode when finding a long term and commercial heat offtake is beyond the immediate control of the operator.		The ability to meet is affected by 3 variables: -the efficiency of the technology employed -the amount of biomass in the waste and -the carbon intensity of the energy source displaced
			Given that the EPS is not expressed in terms of cost-effectiveness it is also not clear what capital and operating costs and gate fees are doing in the report.		The model uses two methods to model the cost of

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			They form part of the tables but seem to play no part at all in scenario selection. The production of syngas from gasification technology to feed CCGT is not currently deliverable. The cost of carbon should be linked to pounds to demonstrate the additional costs involved for some technologies such as the application of gasification.		waste management; the first is gate fee related which is the cost experienced by most Authorities. The second method looks at unit costs for a scheme and helps us to understand what the relative cost of different waste management approaches would be if new infrastructure were provided. In this manner it is possible to get some idea of what the marginal cost would be of converting an EfW from electricity

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					only to CHP operation.
20	Kirsten Thorpe, North London Waste Authority	General, section 1.1	"displaces" - There must be a policy on how to reconcile cost and environmental benefit- we believe that the costs for waste authorities will be significant if they are required to change waste management practices in order to meet the proposed standards.		The response to comment 1. It is typically cheaper to move waste up the waste hierarchy. No change to London's waste activities is expected to increase London's annual waste management bill by about £100m by 2031, mostly due to increases in landfill tax

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			"In this case the marginal source of generation considered to be displaced is combined cycle gas turbine (CCGT) with an assumed carbon intensity of 387 gCO2/kWh, although this could be subject to amendment should an alternative fuel mix be chosen in the future." - The NLWA firmly believes that an alternative fuel mix should be chosen on the basis that in reality EfW will be used to displace existing fuel supply and not used as an alternative to new CCGT facilities.		See Defra guidance/marginal source comment above.
			"options" - This work needs to look at energy generation in the context of whole waste management. We agree that materials should be removed for recycling, but we want to ensure that the EPS and carbon floor do not close out legitimate alternatives to recycling for fossil-fuel derived materials which cannot be recycled.		See response to comment 19 re flexibility/variables affecting the ability to meet the CIF.
			"DECC-approved grid emission factor projections" - What are these likely to be and when will they be confirmed?		See response to comment 1 above.
21	Kirsten Thorpe, North London Waste Authority	General, section 1.2	"update figures with new costs or technology parameters" - It is very important that the model is maintained and updated with new data and reflects any updates made to WRATE, so the tool remains		Agreed

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			relevant and comparable to WRATE as we expect that both tools will be used concurrently.		
22	Kirsten Thorpe, North London Waste Authority	Question 1	The methodology appears relatively robust to deliver the proposed tool. However, the NLWA has provided a mark up on the list of technology suppliers, providing potential additional technologies. A brief summary of the technologies should also be provided, including information such as project status, throughput capacity, whether the facility is a pilot or demonstration plant etc. It is unclear from the report how the NLWA will be able to model their own waste composition within the tool. Composition will play an important role in determining the EPS and carbon floor and we believe that our own composition data should be used and not one of the scenario compositions. Without a copy of the excel sheets, it is quite difficult to see how these sheets are all linked up so we are unable to comment fully on the methodology. Would it be possible to send a draft of the tool to review in		A brief summary of the technologies will be included in SLR's final report Final SLR report will make links to the carbon calculator tool developed for waste authorities to determine performance against the EPS . Waste authorities will be able to model their own waste composition Subsequent workshop held

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			conjunction with the progress report? We also request that we are given an opportunity to provide further feedback once we have attended the steering group meeting next week.		with EPS Steering Group on the carbon calculator tool. Feedback gathered and fed into next version of the tool to be presented at stakeholder workshop 8 July 2011
23	Kirsten Thorpe, North London Waste Authority	Question 2	As the WDA, we do not have any readily available collection costs. We will provide any data we think maybe relevant to this question at a later date.		
24	Kirsten Thorpe, North London Waste Authority	Question 3	Please refer to our budget and levy report published in February 2011 at http://www.nlwa.gov.uk/resources.php.		
25	Kirsten Thorpe, North London Waste Authority	Question 4	Refer to response no.1. We have provided a mark up within the report of additional technologies that may be included.		
26	Kirsten Thorpe, North London Waste Authority	Question 5	Although the Authority commends the development of a tool that will be accessible to all Boroughs, we do have some concerns about how useful this will be to accurately model performance against the EPS, as users will not be able to change assumptions about key		The carbon calculator tool allows users to change/specify assumptions

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			technological aspects (such as energy efficiencies, mass flow, emissions performance etc) and will only be able to rely upon the data already contained within the tool. The Authority believes that the web based tool will be useful to allow Boroughs to appraise and compare the performance of different waste management processes, but not to accurately compare their performance against the proposed EPS and therefore should only be used as an advisory tool.		including plant efficiency, vehicle types, waste composition and the source of energy being displaced. The purpose of the tool is to provide an indicative performance against the EPS at least cost and resource.
			We agree that it is useful to calculate the associated costs with different waste management processes, but feel that some additional information would also be useful such as footprint data and proveness of technology etc, which are also important factors for determining the viability of a waste management solution. We look forward to testing the model and seeing how it compares to our own analysis performed using the WRATE tool.		The EPS has been set based on a mix of technologies commercially proven and used today. The footprint of waste facilities will depend on the size and scale of the facility.

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27	Kirsten Thorpe, North London Waste Authority	General, section 2.1	"The list of technology suppliers that have been contacted is as follows:" - It would be useful for a further summary of these technologies to be provided, in particular, if the facilities are operational, pilot/demonstration etc. Where possible, data should be based on actual operating data and not theoretical data. **"EfW" -** Were London Waste Limited (LWL) consulted? **"Gasification" -** Advanced Plasma Power? "Pyromex" - Is this pyrolysis or gasification?		Final SLR report will provide summary of technologies modelled No, although costs for Belvedere and SELCHP are included as are generic SLR costs. Yes Although pyromex describes itself as Ultra high temperature gasification the reactions are carried out in the absence of oxygen and it is therefore

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					technically a pyrolysis technology although the ultra high temperature avoids the tars and solids associated with pyrolysis technologies. Technically it should be defined as high temperature pyrolysis. Yes but no data was received
			"Clean MRF Technology" - Were Bywaters consulted?		
28	Kirsten Thorpe, North London Waste Authority	General, section 2.2, 2.3	ITI Energy Technical Information - Just a minor point, but this should probably go in a Appendix. "each unit is designed to accept only 8,000 tpa" - At 2.3 you use tpd and tph; it would be useful to standardise for comparison. Such technology would only be suitable for small scale decentralised waste treatment e.g. NLWA would require more than 60 of such units to treat our residual waste stream.		Agreed Final SLR report will mention the issue of scale

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			"£ 30 per MW hour." - This should be expressed as an anticipated gate fee so that it can be compared to what we are paying now and the WRAP data in the table below. This price excludes build costs and a margin for the operator and so is not a price that WDAs would ever be able to realise.		All costs will be converted into a unit cost per tonne
29	Kirsten Thorpe, North London Waste Authority	General, section 2.3	Pyromex Technical Information **- Just a minor point but this should probably go in an Appendix.**		Agreed
			"gasification" - As per our previous comment, can you please confirm if this is gasification or pyrolysis?		Pyromex is a pyrolysis process
30	Kirsten Thorpe, North London Waste Authority	General, section 3.2.2	"primary category level" - Can this be further broken down?		The primary categories are an aggregation of more detailed secondary categories.
			"The model includes the capability to include two additional user-defined compositions" - Can individual Authorities input their own waste into this section?		Yes

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31	Kirsten Thorpe, North London Waste Authority	General, section 3.2.3	"offset will be grid average electricity" - Please refer to our comment no. 2.		Electricity offset will be marginal source (CCGT) but ability to look at other offsets including transport fuel and cement kilns will also be included
32	Kirsten Thorpe, North London Waste Authority	General, section 3.2.6, step 4	"gate fee basis" - The MRF gate fee looks lower than we would expect.		Thankyou and noted
33	Kirsten Thorpe, North London Waste Authority	General, section 3.2.8, sheet 9	"example plot" - We appreciate that dummy figures have been used but we would not expect to see half of all scenarios (particularly if they're all pitched at achieving Landfill Directive and Waste Framework Directive targets and based on the technologies outlined in Sheet 4) to be below the carbon floor and therefore ruled out.		This is a function of the carbon efficiency of the scenarios. The model looks at a whole suite of scenarios some of which will meet the EPS or carbon floor others of which will fail
34	Kirsten Thorpe, North London Waste Authority	General, section 4.1	"As such it is possible to determine the carbon performance of all modelled scenarios." - Are you able to provide some additional detail explaining how the		A description of the methodology will be included in the

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			simplified methodology differs from WRATE? Also a limitations sections would be useful so we are able to understand any constraints within the tool.		final report as will be a limitations section
35	Michael Ojo, London Councils	General	I have nothing to add to the comments already received from colleagues on this. Apologies for not e-mailing yesterday.		
36	Mark Broxup, WRWA	Question 1, general	I think the methodology and purpose of the tool is confused which is not necessarily SLR's fault but could be due to the Mayor's office not being able to articulate clearly enough what it is trying to achieve and why. Everyone I speak to seems to have a different understanding of what the Mayor is trying to achieve in this area and, if the steering group doesn't fully grasp this, what hope has a wider audience got?		The Mayor's draft Municipal Waste Strategy sets out what the Mayor wants to achieve with the EPS. The final strategy will clearly set out how the EPS is to be implemented.
37	Mark Broxup, WRWA	Question 1, general	Our experience of WRATE is that it is actually fairly user friendly in developing models and scenarios in the manner which Fiona was outlining. The only real difficulty comes in interpreting the results produced, particularly as it is essential that the order of magnitude of impacts is considered. Also a balance needs to be struck - carbon is not the only environmental impact that needs consideration.		The GLA's carbon calculator tool provides a cheaper and less prescriptive alternative to WRATE. Other environmental impacts of waste infrastructure - air

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					quality, noise, traffic etc will be addressed through the planning process as normal.
38	Mark Broxup, WRWA	Question 1, general	I also struggle to understand what value is to be placed on the financial analysis - there is only one test that matters - the evaluation carried out when an authority tenders its contract(s) in line with European procurement requirements. Even if the financial analysis was accurate, which I personally doubt it will be, is the GLA seriously considering incurring the ongoing cost of updating it?		London's waste authorities have to act in general conformity with Mayor's Municipal Waste Management Strategy. The financial analysis undertaken by SLR evidence a range of costed waste scenarios to meet the EPS. The GLA will monitor London's performance against the EPS and cost implications
39	Mark Broxup, WRWA	Question 1, general	As others have alluded to, I do not understand, on a number of levels, what this model is trying to achieve,		SLR's report analyses in more

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			or quite how it follows on from the Eunomia report.		detail the financial and technical implications of a wider range of waste management scenarios than those modelled by Eunomia to meet the EPS
40	Mark Broxup, WRWA	Question 1, general	Is it trying to model performance against the Gas Emissions Performance Standard or the Carbon Floor?		Both
41	Mark Broxup, WRWA	Question 1, general	It is also unclear how the carbon and financial elements relate to each other e.g. at what cost level will you be able to ignore the Gas Emissions performance standard or Carbon floor?		See response to comment 38 above. The model is intended to show compliant options and the affordability of those options. Some options that meet the floor may be too expensive to implement and would therefore

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					not be considered as being affordable or offering value for money
42	Mark Broxup, WRWA	Question 1, general	What is the rationale for using CCGT as the comparator technology? This needs to be fully justified as coal or grid average would seem to me to be a more logical choice.		See response to comment 19 above.
43	Mark Broxup, WRWA	Question 1, general	What exactly is it that the "ready reckoner" offers over and above WRATE? I accept that WRATE may not be perfect but see little value in trying to set London apart from the rest of the country and I doubt it will be seen as a positive development by waste contractors.		See responses to comments 26 and 37 above
44	Mark Broxup, WRWA	Question 1, general	If there are concerns that WRATE does not reflect carbon use accurately then should that debate not be had with the EA by properly qualified LCA experts - not waste managers?		The GLA carbon calculator tool will be updated in response to any updates to WRATE
45	Mark Broxup, WRWA	Question 1, general	How do/will London wide targets be translated into individual authorities performance?		Targets in the Mayor's Municipal Waste Management Strategy are for London only. Local authority performance will

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					be determined by its ability to meet the EPS.
46	Mark Broxup, WRWA	Question 1, general	Given the timescales how will the model reflect the fact that many major WDA contracts are longer than a lot of the strategy target timeframes?		The EPS will only apply to new waste authority contracts. Waste authorities will need to demonstrate how they will meet the EPS over the lifetime of the contract
47	Mark Broxup, WRWA	Question 1, general	Does the GLA have an expectation that the renewal of collection contracts (particularly in 2-tier areas) will somehow alter WDA contracts? I am concerned because, if this is the expectation, it is unlikely to be achieved and could even lead to future confrontation.		No.
48	Mark Broxup, WRWA	Question 1, general	Why couldn't a simple improvement in current WRATE output performance be set for authorities to strive for i.e. a percentage improvement in the area of waste performance that they are responsible for - as and when contracts come for renewal? This might at least help overcome the confusion surrounding the model and how it is supposed to be used.		This is essentially the approach we are taking – waste authorities demonstrating incremental changes over time to waste services

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					through existing and new contracts to meet the EPS.
49	Mark Broxup, WRWA	Question 1, general	Can the GLA confirm that model does not use as its stating point a measurement of current performance and then an aim to improve on that? Is the model actually predicated on meeting the Mayor's weight based recycling targets? Does this explain why the outputs seem to be so skewed to recycling led solutions? Can the answers to these questions also be related back to the earlier question of how London wide targets will be translated down to individual authority level?		See comments in response 1. Generally recycling is cheaper than landfill or energy generation and offers the greatest carbon saving benefits for meeting the EPS. The EPS offers a flexible approach as opposed to prescribing technologies or waste services.
50	Mark Broxup, WRWA	Question 1, general	Can it be explained how the waste prevention, reduction and reuse initiatives will affect modelled outcomes?		Such initiatives are not yet recognised in setting and achieving the EPS. Such initiatives are expected to make an effective

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					contribution to meeting the EPS. The GLA's carbon calculator tool has built-in flexibility to include emission factors for reduction and reuse initiatives, expected to be available in 2011.
51	Mark Broxup, WRWA	Question 1, general	How will use of existing facilities be compared to proposals to construct new ones? The construction phase of waste treatment facilities is very carbon intensive but, if the facility already exists, we can't turn back time and but the carbon back into the ground. It would seem to me that maximising the use of existing facilities is likely to be extremely more carbon efficient than building alternative new ones.		There is no comparison. WRATE LCA methodology used to set the EPS accounts for emissions associated with the construction of waste facilities (existing or new)
52	Mark Broxup, WRWA	Question 1, page 13	The report says that "Relevant activities will cover the full scope of an integrated waste management service" yet, by ignoring transport activities it plainly does not. This deficiency seems to become even more confusing		Transport emissions are now included in EPS

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			when, on page 13, the SLR report says that "Based on the calorific value of fuel input offset of diesel is twice as effective as offsetting gird average electricity." Therefore moving large volumes of residual waste by rail or river has must have a measurable effect as must the negative effect of congestion on other road users when trying to sort material at kerbside.		
53	Mark Broxup, WRWA	Question 1, general	Similarly what are the start and end points of the systems being evaluated? To my mind the start should be from the provision of collection containers/sacks thru collection vehicles all the way to final treatment wherever it may be i.e. the transport impacts of exporting recyclables to the Far East should be accounted for as should the full impact of RDF production and its transportation to, and treatment at, the cement kiln or other combustion facility (the evaluation should not stop when the material leaves the Greater London area).		The transport system boundaries are consistent with London Plan waste apportionment policy for waste deemed to be managed within London. The system boundaries will be set out in SLR's final report
54	Mark Broxup, WRWA	Question 1, general	Is any weighting to be given to technology robustness or deliverability? i.e. Hitachi's proven technology at Belvedere (with many world-wide operations treating millions of tonnes annually should not be ranked equally alongside ITI Energy with seemingly little more than a demonstration plant in a university laboratory.		No. The Mayor has taken a technology neutral approach
55	Mark Broxup,	Question 1, general	The research and data compilation section of the SLR		The final SLR report

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	WRWA		report seems particularly weak with only 2 prototype technologies seemingly having responded.		will set out details of technologists that have responded and will be augmented by SLR datasets
56	Mark Broxup, WRWA	Question 2	We have no data		
57	Mark Broxup, WRWA	Question 3	We have no data		
58	Mark Broxup, WRWA	Question 4	We have none to add but stress that there needs to be proper account taken of the deliverability (in planning and funding terms) and proven reliability of technologies		

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