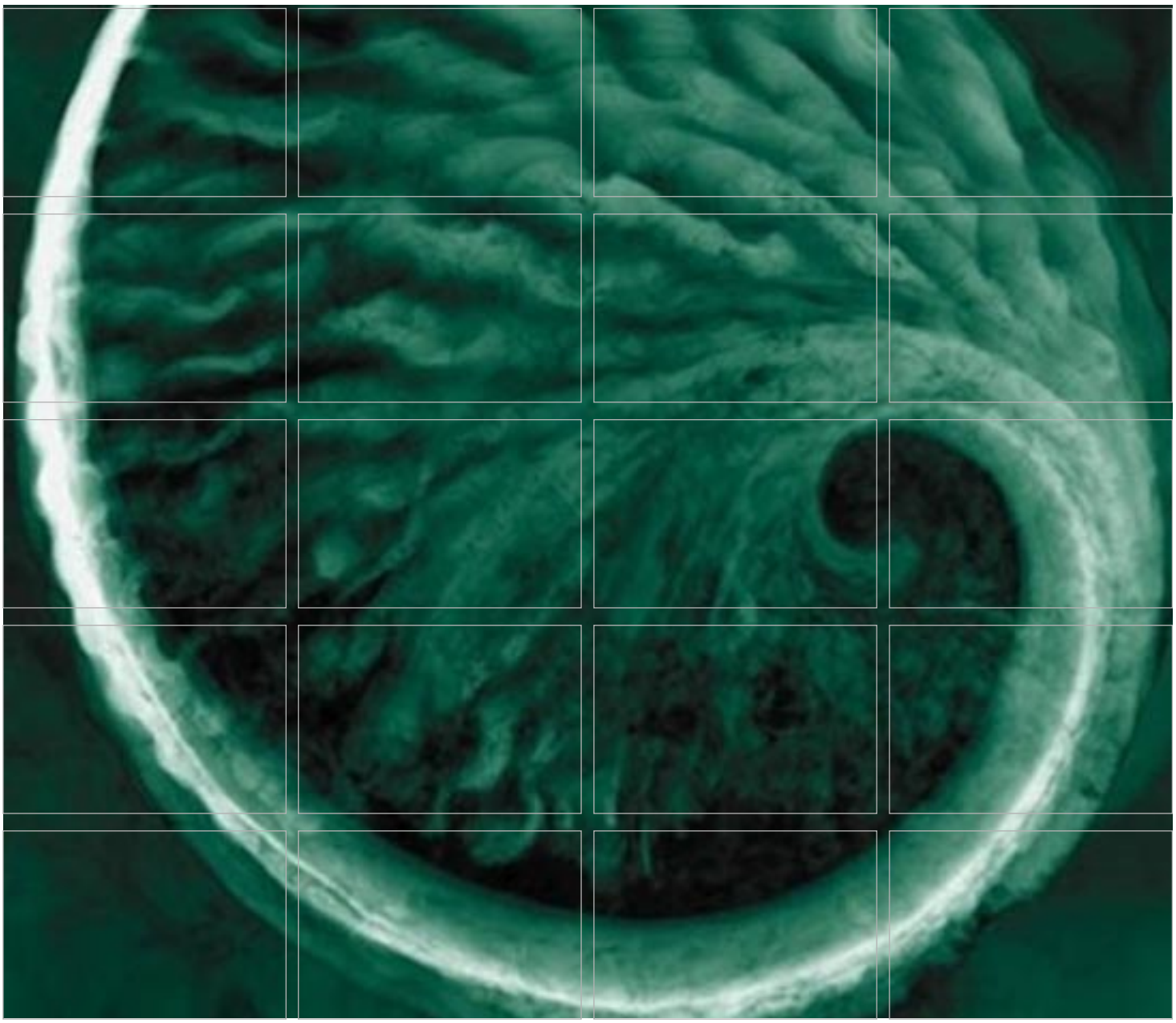

Residual Options Appraisal

Executive Summary to Annex 5

Report

March 2006

Delivering sustainable solutions in a more competitive world

ERM

Kent Waste Forum

Residual Options Appraisal

Executive Summary to Annex 5

Report

March 2006

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For and on behalf of
Environmental Resources Management

Approved by: Simon Aumônier

Signed: 

Position: Partner

Date: 31st March 2006

1 EXECUTIVE SUMMARY

1.1 INTRODUCTION

The Waste and Emissions Trading Act (2003) introduced the Landfill Allowance and Trading Scheme (LATS), under which challenging targets for the diversion of biodegradable municipal waste from landfill have been introduced for each Waste Disposal Authority (WDA) in England. If a WDA fails to meet its targets directly it may purchase allowances from other WDAs or borrow against future excess capacity. If a WDA cannot cover its shortfall by purchasing allowances or borrowing, Government has made provision for them to be fined £150 per tonne of excess biodegradable municipal waste landfilled

No allowance is made within the targets for per capita growth in waste production, or for the effects of demographic growth; and therefore meeting these targets becomes more challenging when economic growth is taken into account. Despite declining birth rates in England, Kent is predicting significant population growth which will have the effect of increasing waste arisings.

A series of options for the production of treatment facilities across the county have been developed. These present only indicative routes for meeting LATS. In order to assess and appraise these options, a number of environmental, social and economic criteria were developed. This approach will help the Kent authorities with the strategic decision-making process by identifying the potential environmental, social and financial costs of each option.

1.2 CRITERIA SELECTION AND OPTION DEVELOPMENT

A technical options appraisal requires that the performance of options be assessed through a range of criteria in order to identify the option(s) that performs best overall.

The residual options were identified through consultation with the Kent Waste Forum and the wider stakeholder network. These options, except for option 8, are based on achieving a household recycling and composting rate of 40% by 2015 and allow for all annual LATS targets to be met. Option 8 incorporates additional composting of kitchen waste, resulting in a recycling and composting rate of 49%. The options developed are shown in *Table 1.1* below.

Table 1.1 Residual Waste Options

Option	Description
Option 1	New Energy for Waste facility in East Kent
Option 2	Expand current contracted capacity at Allington EfW
Option 3	Mechnical Biological Treatment (MBT) plant in East Kent providing Refuse Derived Fuel (RDF) to Allington EfW
Option 4	MBT plant in East Kent stabilising material to landfill
Option 5	Autoclave in East Kent with 'fluff' to Allington EfW
Option 6	Gasification plant in East Kent
Option 7	Anaerobic Digestion facility in East Kent
Option 8	In-vessel composting facilities across Kent for Garden and Kitchen Waste

The principal assumptions made for each option during the modelling are discussed in detail in *Section 1.3* of the main report.

Workshops were held with each of the Districts and Kent County Council (KCC) to identify the assessment criteria appropriate for Kent. These were then agreed by the Kent Waste Forum. A detailed list of the assessment criteria chosen is shown in *Table 1.1* of the main report.

1.3 APPRAISING THE RESIDUAL WASTE OPTIONS AGAINST PERFORMANCE CRITERIA

The methods used for assessing the recycling and composting options against each of the criterion are explained below, with the results of this modelling process are presented in the summary table. The following sections describe each criterion and what makes them perform well or badly.

1.3.1 Impact of Resource Use (Resource Depletion)

Resource depletion is an important concern because current levels of consumption of non-renewable resources are thought to be unsustainable. Crude oil, coal and gas are natural, non-renewable resources and therefore limited.

Options that perform well against this criterion include Anaerobic Digestion (AS) and autoclaving, as these are assumed to separate both plastics and metals for recovery, thereby having high resource recovery benefits through displacing the production of virgin materials.

Options perform badly if the costs of waste processing and transport are higher than the potential benefit from resource depletion. For example, Options 4 and 8 perform worst as the additional treatment technologies do not involve any energy recovery.

1.3.2 Air Pollution (Acidification)

Previous assessments of the acidification impact of integrated waste management processes have found that SO_2 emissions are the greatest contributor to the acidification impact, with NO_x emissions the second largest contributor [(1)]. For this study, we have focused solely on SO_2 emissions.

Options perform well due to the recovery of greater amounts of plastics and metals than other options through displacing virgin materials. Options 7 and 5 perform best.

Options 4 and 8 perform least well due to a lack of energy production in both options.

1.3.3 Emissions of Greenhouse Gases

Human activities have altered the chemical composition of the atmosphere through the build-up of greenhouse gases. The higher the concentration of these gases, the higher the heat-trapping capability of the earth's atmosphere.

Options that increase the recovery of materials for recycling perform well as they lead to a greater displacement of CO_2 equivalent emissions. Therefore options with autoclave and AD as the lead treatment technology perform better than other options.

Option 2, for example, does not displace the same quantity of electricity from the national grid and therefore performs poorly.

1.3.4 Energy Consumption

Energy consumption is an important factor in sustainability, affecting all aspects of development. By using less energy, carbon emissions can be reduced and energy supplies can be secured.

Options that recover materials perform well because less energy is used than where the materials are produced from virgin resources. Producing virgin plastics is energy intensive and recovering this resource will result in energy consumption benefits. Therefore a higher level of material recycling, in addition to some energy recovery, results in options 5 and 7 ranking highest.

Options performing badly include those that do not involve energy recovery, such as options 4 and 8.

1.3.5 Impact on Human Health

Constructing new waste management facilities can often be seen as controversial in terms of their perceived public health impacts. There are

(1) Enviros Aspinwall (January 2002) arc21 - Consultation Waste Management Plan

numerous conflicting reports and opinions about the relative impacts of different facilities. ERM has used a health effects report published by Defra (1) as the basis for assessment in this study.

High performing options include option 7, as AD combined with landfilling of the end product from the process is relatively benign.

Options employing mass burn energy from waste have the greatest potential impact to human health and therefore perform less favourably.

1.3.6 Landtake

Land is a finite resource. The Government are encouraging the use of brownfield site development and the reuse of buildings in order to prevent development occurring on greenfield sites. This criterion considers the amount of land required to be given up on a long-term basis.

Options that reduce the amount of land required perform best under this criterion. Option 8 reduces the quantity of land required through the use of in-vessel compost facilities and therefore performs best.

The options that perform worst result in the disposal of the end product to landfill, requiring a large amount of land. However, there are examples of former landfills being put to good use for leisure facilities once the landfill has closed.

1.3.7 Impact on Water Pollution

Pressure on water resources in the south-east of England from increased consumption and lower than average rainfall increases the need to protect the resources available. Lower river flows have a reduced capacity to cope with wastewater discharges and pollution incidents so the importance of protecting these resources has increased.

Options performing best involve a high recovery of plastics and metals from waste, thereby reducing the quantity of waste combusted and therefore the amount of hazardous and non-hazardous waste sent to landfill. Other high performing options include those that use processes that produce limited outputs or residues that require further treatment; that do not require any new facilities to be built and that do not involve any further risk to waste than that already in place under the current contract.

Option 8 performs worst in this criterion as the number of facilities for processing compost significantly increases the risk associated with this option, even though the facilities are small and individually pose less of a risk than the other proposed plants.

(1) *Review of Environmental and Health Effects of Waste Management: Municipal Solid Waste and Similar Wastes*, Enviros Consulting Ltd and University of Birmingham with Risk and Policy Analysts Ltd, Open University and Maggie Thurgood, 2004, available at http://www.defra.gov.uk/environment/waste/health-effects/index.htm [01Jun04 @ 15:13]

1.3.8 Total Road Kilometres

Reducing road traffic and the need to travel by road is a key factor in sustainability objectives. An assessment was made of the expected road distance travelled for alternative options to indicate the impact on local transport on each option.

Options performed well if the materials were transported locally, specifically within Kent.

Options performed poorly if the materials needed to be transported longer distances. For example, options involving plastic recycling performed badly as the material needed to travel to the north of England for reprocessing.

1.3.9 Financial Costs

A problem commonly associated with data on the financial costs of waste management activities is the acquisition of detailed, reliable and up-to-date information and the necessity to rely on small and dated data sets in forecasting future costs. Costs associated with each option have been assessed on an operational and capital cost basis.

Option 8 performs best overall. Despite the initial investment in the in-vessel composting facilities, the additional level of composting associated with this option significantly reduces landfill costs.

Options performing worst would involve the highest cost. Option 4 performs worst as it involves gate fees from landfill and high operational and capital costs from the MBT and EfW facility.

1.3.10 Reliability of Delivery

Reliability of delivery encompasses a number of subsidiary factors. The key issues with this criterion are the probability of securing planning permission for new facilities and the prospects for technologies that are not entirely proven.

In this case, Option 2 performs best overall. This involves the expansion of the Allington EfW contract which requires no new facilities and the EfW technology is well proven.

Options performing badly against this criterion include those that would require planning permission and those which the technologies are not entirely proven. Options 5 and 6 perform least well as these technologies are not entirely proven and it may prove more difficult to secure planning permission.

1.3.11 Compliance with Waste Policy

This criterion assesses the ability of each option to manage waste in accordance with UK waste policy. Government policy seeks to drive the management of waste up the waste hierarchy. This hierarchy reflects the fact that the best option for dealing with waste is to reduce the amount created, followed by reuse, recycling and composting, energy recovery and finally disposal.

Options providing increased tonnages for recycling and composting, and therefore reducing the dependence on landfill, perform best against this criterion. Option 8 performs best overall as compostable kitchen waste is also collected as part of this option.

Options performing least well include those where waste is thermally treated, resulting in more waste being landfilled.

1.3.12 End Product Liability

Some waste management technologies have greater risks associated with the management of end products as the market for these materials are unproven or under-developed. This criterion considers the risks associated with finding a market willing to accept the end products arising from the technologies used by each option.

Options performing best include options 1 and 6. The thermal treatment of waste does not significantly increase the liability associated with hazardous waste. Relatively small quantities of hazardous residues are produced.

Options 5 and 7 perform worst due to the production of large quantities of recyclate and RDF produced by the autoclave and the extra material collected for composting respectively.

1.3.13 Employment Opportunities

The increase in long and short term employment opportunities within the County created by the operations phase of new waste management facilities is an important criterion in terms of benefits to the local community and the local economy.

Options requiring greater construction manpower perform well as the resulted increase in employment opportunities benefit the local community and economy.

Options performing badly are those that do not require the construction of any new facilities. Option 2 relies on one EfW plant and as the waste flow is concentrated through one existing facility the number of operatives and construction staff is reduced.

1.4 SENSITIVITY ANALYSIS

1.4.1 *The Need for Sensitivity Analysis*

The results of the options appraisal showed that option 7, the commissioning of an anaerobic digestion (AD) plant to serve East Kent, performed best against a number of criteria, specifically those dealing with environmental performance. Option 7 performed well as a significant proportion of environmental benefit was awarded to upfront plastics recycling associated with the process. An alternative option, 7a, was developed to reflect an identical anaerobic digestion plant as that modelled for option 7 in the original assessment. Again the plant separates plastics and other materials for recycling prior to digestion. However, it is assumed that the separated plastics will be of poor quality, unsuitable for recycling and instead will be sent to landfill.

1.4.2 *Summary of Results*

The results show that, where option 7 out-performed all the other options against the environmental criteria (depletion of resources, air acidification, greenhouse gas emissions, energy consumption), option 7a performs less well. Instead, autoclaving, option 5, is the higher-performing technology. This is an expected outcome as the plastics recycling previously allocated to the AD option is rewarded with a considerable resource depletion and energy benefit, to account for high consumption during virgin material production. The removal of this recycling benefit has a significant effect on the overall benefits offered by anaerobic digestion.

We can conclude that the results for AD are highly sensitive to the inclusion of a pre-sorting process for plastics. When the results of the residual options appraisal are employed, account should be taken of the less favourable performance of AD against the environmental criteria should pre-sorted plastics be unusable or unsuitable for recycling.

Summary of Residual Waste Options Results

Criterion	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8
Depletion of resources (tonnes of crude oil equivalents)								
Score	-3,411,017	-3,393,398	-3,394,507	-3,311,400	-3,461,535	-3,428,183	-3,565,545	-3,309,702
Rank	(4)	(6)	(5)	(7)	(2)	(3)	(1)	(8)
Value	0.40	0.33	0.33	0.01	0.59	0.46	1.00	0.00
Air acidification (tonnes of sulphur dioxide)								
Score	-31,939	-31,831	-32,027	-31,572	-32,243	-32,058	-32,784	-31,309
Rank	(5)	(6)	(4)	(7)	(2)	(3)	(1)	(8)
Value	0.43	0.35	0.49	0.18	0.63	0.51	1.00	0.00
Greenhouse gas emissions (tonnes of carbon dioxide equivalents)								
Score	-5,361,810	-5,351,544	-5,351,831	-5,364,684	-5,602,111	-5,408,378	-5,768,375	-5,088,642
Rank	(5)	(7)	(6)	(4)	(2)	(3)	(1)	(8)
Value	0.40	0.39	0.39	0.41	0.76	0.47	1.00	0.00
Health impacts (health impacts score)								
Score	0.5548	0.5464	0.5379	0.5075	0.5454	0.5066	0.4963	0.4993
Rank	(8)	(7)	(5)	(4)	(6)	(3)	(1)	(2)
Value	0.00	0.14	0.29	0.81	0.16	0.82	1.00	0.95
Energy consumption (GJ)								
Score	-169,297,001	-168,404,221	-168,343,617	-164,012,945	-173,051,689	-170,173,353	-177,576,344	-164,352,797
Rank	(4)	(5)	(6)	(8)	(2)	(3)	(1)	(7)
Value	0.39	0.32	0.32	0.00	0.67	0.45	1.00	0.03
Total road kilometres (te-km)								
Score	52,073,274	51,653,330	53,301,919	52,065,179	56,790,470	52,156,058	55,993,597	52,113,145
Rank	(3)	(1)	(6)	(2)	(8)	(5)	(7)	(4)
Value	0.92	1.00	0.68	0.92	0.00	0.90	0.16	0.91
Employment opportunities (annual average no. of total jobs)								
Score	429.8	408.5	429.9	432.3	430.8	431.2	417.9	433.0
Rank	(6)	(8)	(5)	(2)	(4)	(3)	(7)	(1)
Value	0.87	0.00	0.87	0.97	0.91	0.93	0.38	1.00
Compliance with policy (tonnes recycled/composted)								
Score	1.54	1.54	1.52	1.50	1.55	1.54	1.59	1.68
Rank	(4)	(6)	(7)	(8)	(3)	(4)	(2)	(1)
Value	0.23	0.20	0.13	0.00	0.28	0.23	0.48	1.00
Liability of end product (tonnes recycled/composted)								
Score	2.24	2.25	2.42	2.26	2.52	2.24	2.27	2.52
Rank	(1)	(3)	(6)	(4)	(8)	(2)	(5)	(7)
Value	1.00	0.96	0.35	0.93	0.00	0.99	0.90	0.00
Deliverability & Risk								
Score	7.00	8.00	6.00	6.00	4.00	4.00	6.00	5.00
Rank	(2)	(1)	(3)	(3)	(7)	(7)	(3)	(6)
Value	0.75	1.00	0.50	0.50	0.00	0.00	0.50	0.25
Water Pollution								
Score	1204	1177	1195	1216	1190	1190	1215	1219
Rank	(5)	(1)	(4)	(7)	(2)	(2)	(6)	(8)
Value	0.35	1.00	0.57	0.08	0.68	0.68	0.10	0.00
Land Use								
Score	106.8	107.0	107.0	109.7	106.6	106.8	107.0	101.8
Rank	(3)	(6)	(5)	(8)	(2)	(4)	(7)	(1)
Value	0.37	0.35	0.35	0.00	0.40	0.37	0.34	1.00
Cost								
Score	39.19	38.40	40.12	40.54	40.10	39.49	39.70	37.84
Rank	(3)	(2)	(7)	(8)	(6)	(4)	(5)	(1)
Value	0.50	0.79	0.15	0.00	0.16	0.39	0.31	1.00

Option	Description
Option 1	New Energy for Waste facility in East Kent
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Option 4	MBT plant in East Kent stabilising material to landfill
Option 5	Autoclave in East Kent with 'fluff' to Allington EfW
Option 6	Gasification plant in East Kent
Option 7	Anaerobic Digestion facility in East Kent
Option 8	In-vessel composting facilities across Kent for Garden and Kitchen Waste

Key

- Best Performing Option
- Second Best Performing Option
- Next to Worst Performing Option
- Worst Performing Option

Summary of Sensitivity Residual Waste Options Results including Option 7a

Criterion	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7a	Option 8
Depletion of resources (tonnes of crude oil equivalents)								
Score	-3,411,017	-3,393,398	-3,394,507	-3,311,400	-3,461,535	-3,428,183	-3,396,496	-3,309,702
Rank	(3)	(6)	(5)	(7)	(1)	(2)	(4)	(8)
Value	0.67	0.55	0.56	0.01	1.00	0.78	0.57	0.00
Air acidification (tonnes of sulphur dioxide)								
Score	-31,939	-31,831	-32,027	-31,572	-32,243	-32,058	-32,187	-31,309
Rank	(5)	(6)	(4)	(7)	(1)	(3)	(2)	(8)
Value	0.67	0.56	0.77	0.28	1.00	0.80	0.94	0.00
Greenhouse gas emissions (tonnes of carbon dioxide equivalents)								
Score	-5,361,810	-5,351,544	-5,351,831	-5,364,684	-5,602,111	-5,408,378	-5,596,651	-5,088,642
Rank	(5)	(7)	(6)	(4)	(1)	(3)	(2)	(8)
Value	0.53	0.51	0.51	0.54	1.00	0.62	0.99	0.00
Health impacts (health impacts score)								
Score	0.5548	0.5464	0.5379	0.5075	0.5454	0.5066	0.4973	0.4993
Rank	(8)	(7)	(5)	(4)	(6)	(3)	(1)	(2)
Value	0.00	0.15	0.29	0.82	0.16	0.84	1.00	0.96
Energy consumption (GJ)								
Score	-169,297,001	-168,404,221	-168,343,617	-164,012,945	-173,051,689	-170,173,353	-168,331,533	-164,352,797
Rank	(3)	(4)	(5)	(8)	(1)	(2)	(6)	(7)
Value	0.58	0.49	0.48	0.00	1.00	0.68	0.48	0.04
Total road kilometres (te-km)								
Score	52,073,274	51,653,330	53,301,919	52,065,179	56,790,470	52,156,058	52,432,685	52,113,145
Rank	(3)	(1)	(7)	(2)	(8)	(5)	(6)	(4)
Value	0.92	1.00	0.68	0.92	0.00	0.90	0.85	0.91
Employment opportunities (annual average no. of total jobs)								
Score	429.8	408.5	429.9	432.3	430.8	431.2	417.9	433.0
Rank	(6)	(8)	(5)	(2)	(4)	(3)	(7)	(1)
Value	0.87	0.00	0.87	0.97	0.91	0.93	0.38	1.00
Compliance with policy (tonnes recycled/composted)								
Score	1.54	1.54	1.52	1.50	1.55	1.54	1.53	1.68
Rank	(3)	(5)	(7)	(8)	(2)	(3)	(6)	(1)
Value	0.23	0.20	0.13	0.00	0.28	0.23	0.17	1.00
Liability of end product (tonnes recycled/composted)								
Score	2.24	2.25	2.42	2.26	2.52	2.24	2.25	2.52
Rank	(1)	(4)	(6)	(5)	(8)	(2)	(3)	(7)
Value	1.00	0.96	0.35	0.93	0.00	0.99	0.97	0.00
Deliverability & Risk								
Score	7.00	8.00	6.00	6.00	4.00	4.00	6.00	5.00
Rank	(2)	(1)	(3)	(3)	(7)	(7)	(3)	(6)
Value	0.75	1.00	0.50	0.50	0.00	0.00	0.50	0.25
Water Pollution								
Score	1204	1177	1195	1216	1190	1190	1233	1219
Rank	(5)	(1)	(4)	(6)	(2)	(2)	(8)	(7)
Value	0.51	1.00	0.68	0.31	0.76	0.76	0.00	0.25
Land Use								
Score	106.8	107.0	107.0	109.7	106.6	106.8	107.0	101.8
Rank	(3)	(6)	(5)	(8)	(2)	(4)	(7)	(1)
Value	0.37	0.35	0.35	0.00	0.40	0.37	0.34	1.00
Cost								
Score	39.19	38.40	40.12	40.54	40.10	39.49	40.54	37.82
Rank	(3)	(2)	(6)	(7)	(5)	(4)	(8)	(1)
Value	0.50	0.78	0.15	0.00	0.16	0.39	0.00	1.00

Option	Description
Option 1	New Energy for Waste facility in East Kent
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Option 6	Gasification plant in East Kent
Option 7a	Anaerobic Digestion Sensitivity
Option 8	In-vessel composting facilities across Kent for Garden and Kitchen Waste

Key	
	Best Performing Option
	Second Best Performing Option
	Next to Worst Performing Option
	Worst Performing Option