Appendix 2
Assessment Socio-economic and Operational Objectives

CONTENTS

A2.1 INTRODUCTION

This Appendix presents the results of the assessment of socio-economic and operational objectives of a number of waste management scenarios for Darlington. Seven scenarios were assessed (detailed in Section 3) which focus on the residual waste treatment and the potential impact of different treatment technologies and facilities and the associated costs.

Table A2- 1: Summary of objectives and indicators

Socio-economic Objectives	Indicators
8. To provide local employment opportunities	Number of jobs created (jobs estimated)
9. To provide opportunities for public involvement / education	Potential for participation in recycling and composting (% households with kerbside collection of recyclables and organics)
10. To minimise costs of waste management	Overall costs (£million 2009 - to 2034) - *WASTEFLOW*

Operational Objectives	Indicators
11. To ensure reliability of delivery	Maturity of technology (performance score)
	Public acceptance / Achievement of planning permission (performance score)
	Public involvement required (participation rate)
12. To conform with waste policy	Percentage of material recovered (%)
	Percentage of material recycled/composted (%)
	Percentage of BMW diverted from landfill (%)

A2.2 Methodology

All costs are given at 2004 prices. Collection costs are based on transport and labour requirements plus the cost of providing containers where necessary. Treatment costs are based on the capital and operating costs for waste treatment plants plus transport and residue landfilling costs minus any income from energy recovery or recycled material sales. Income from waste treatment charges on commercial customers has not been considered.

All scenarios are assumed to be fully operational by 2011. Generally, professional judgement has been applied as to the phasing of various collection and treatment operations taking account of, for example, time necessary to secure required authorisations, planning permissions and construction periods. This time schedule requires much effort in planning in the next few years to achieve these targets.

In all scenarios it is assumed that the existing disposal and treatment facilities will be used until new facilities are built. Scenario 1, 2, 4, 5, and 6 assume residual waste treatment facilities will be built at site in Darlington by 2011. The Base Case, Scenario 1 and Scenario 3 assume that a transfer facility will be built at a site within Darlington, at which waste will be bulked ready for transport onto landfill or EfW treatment.

The analysis has been undertaken using AEA Technology's WASTEFLOW cost and performance model. The capital and operating cost of the treatment and disposal operations are based on industry norms and proprietary sources[1].

The cost of each scenario has been assessed using a discounted cash flow model. Having determined the various mass flows for the scenario over the period to 2034 the required processing capacity (for composting, EfW etc) has been determined and hence the capital and operating costs associated with these facilities. The projected annual revenue cost to the Council to year 2034 is then determined and the cost in any given year can be identified.

The costs have been calculated after the annual massflows of waste have been determined and these in turn have relied on an assessment of the logistics of implementation e.g. time taken to procure, authorise, build and commission facilities. These technologies provide a benchmark against which alternative systems can be assessed for example at the time of procurement.

[1] AEA Technology have direct access to competitively tendered cost information (for various waste management systems) as part of their activity in the environmental consultancy sector – this confidential source information has been used to inform the capital and operating costs used in this assessment.

A2.2.1 WASTEFLOW ASSUMPTIONS

The WASTEFLOW model uses the discounted cash flow technique (DCF) to compare the costs of different scenarios on a like-for-like basis. Whilst the DCF technique is a convenient tool for comparative purposes, it is not the way in which financing for a specific project is determined. This is because, for financing, issues of risk allocation to contracts, levels of debt/equity and other such factors come into play. Nevertheless, the technique provides a reliable method for the appraisal of capital intensive projects. The DCF technique relate, in terms of present worth, the value of revenues and costs, which occur over the economic life of the project.

For a given discount rate, the DCF technique determines the gate fee (or annual cost) required to equate the net present value of costs (capital and operating) with the net present value revenues (from power sales, recyclables). A discount rate of 6% has been used for the purposes of this analysis. This is a competitive rate, which, in the present analysis also compensates for some of the development costs (e.g. financing) not explicitly included in our analysis. The discount rate chosen reflects the average cost of capital for the project; it is a real discount rate, i.e. inflation has been assumed to affect all cash flows to the same extent, enabling it to be excluded from the analysis.

Further base line assumptions of the cost evaluation are listed in Table 3-5 in Section 3 of the main report.

A2.2.2 PERFORMANCE AGAINST TARGETS

Figure A2- 1 shows the performance of the scenarios against the recycling targets. All scenarios are designed to get above the BVPI recycling target of 18%. It shows the amount of waste production predicted and counted as recycled under the current Best Value Performance Indicator guidance. All the scenarios meet or exceed the 18% BVPI target through out the period covered by the modelling.

Scenario 1 (High recycling), has the highest recycling rate of all of the scenarios achieving around 40%. The Base Case scenario, Scenario 2 and Scenario 3 all have identical recycling levels of 23%.

It should also be noted that although MBT-AD, gasification and EfW all include recycling of some materials. Only the front end recycling found in MBT-AD and gasification plants counts as recycling under the definition of BVPIs. The recovery of metals post combustion in an EfW facility does not count as recycling under BVPI. Hence the performance of MBT-AD and gasification appears better on the graph in Figure A2- 1.

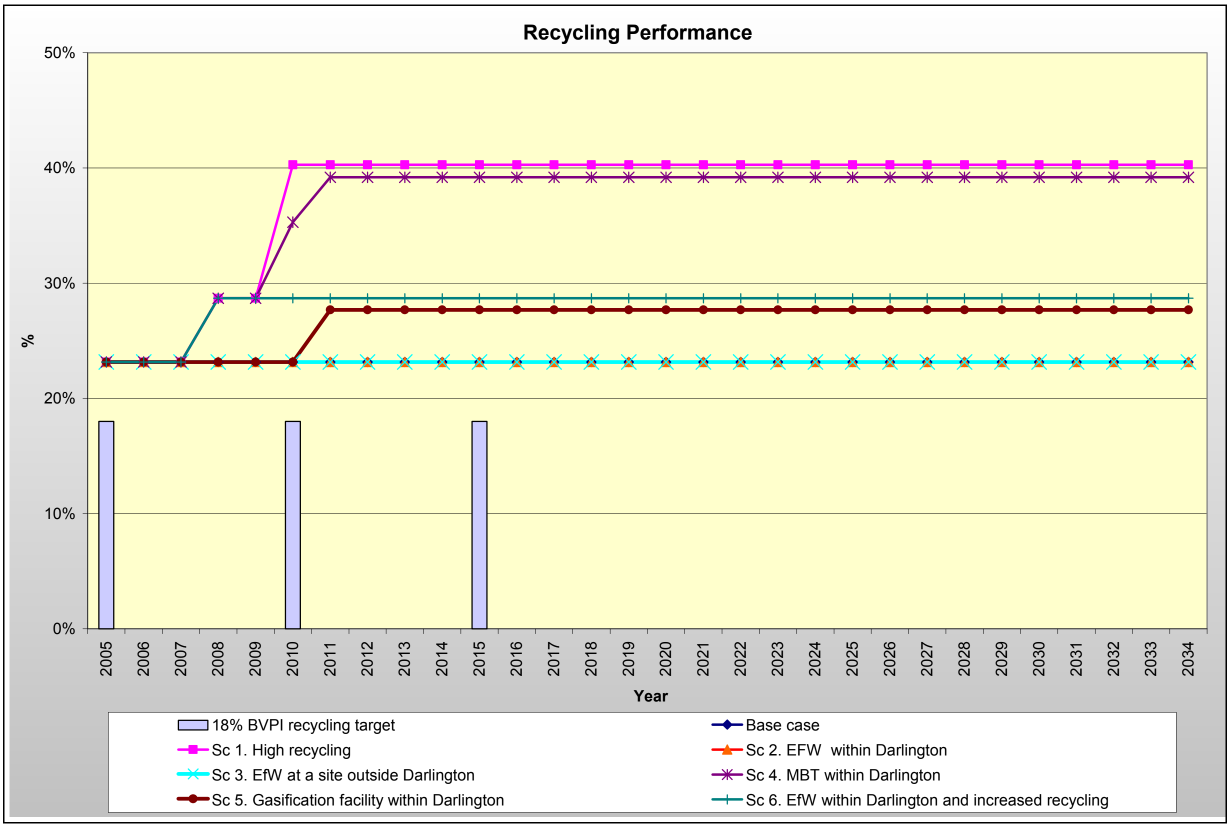

Figure A2- 1: Achievement of recycling targets

The development of treatment technologies to deal with the residual waste stream means that the biodegradable waste sent to landfill is substantially reduced in all of the scenarios other than the Base Case and Scenario 1. This is indicated in Figure A2- 2 that shows the performance against the Landfill Allocation Trading Scheme (LATs).

The Landfill Directive will impose demanding requirements to limit the amount of biodegradable municipal waste (BMW) being landfilled in the UK. The Government has implemented this Directive by issuing allowances to landfill BMW, which can be traded between local authorities. An allocation on the amount of BMW that can be landfilled each year from 2005/06 to 2019/20 has been provided to Darlington. Figure A2- 2 shows the allocated amount allowed for landfilling for each year.

Figure A2- 2 shows that when the thermal treatment processing technologies (EfW & Gasification) are adopted in 2011 the diversion rates of BMW from landfill are within the allocation of LATS. Between these two technologies there is little variation in the performance with regards to BMW diversion. The exceeding of these landfill allocations will allow the generation of tradable permits that can be sold to other authorities that have not met their targets. This will generate an income stream, but the value will be determined under market conditions and thus will vary from year to year.

Although MBT-AD technologies can be used to treat all the residual waste, the technologies performance against LATs is not as good as EfW or gasification. This is due to Environment Agency guidance, which makes it unlikely that compost/digestate produced by MBT-AD facilities can be utilised, but has to be landfilled and not sold or put to use. As the compost/ digestate produced will still be biodegradable (although the proportion of biodegradable content will have been reduced) any remaining biodegradability will count against LATs targets. The modelling assumes a 50% reduction in biodegradability (from 68 to 34%) based on Environment Agency guidance. If the performance of the MBT-AD system could reduce this further, the gap between LATS allowances and the actual amount of biodegradable waste would be reduced thus negating the need to buy as many permits.

Obviously, if markets for the RDF product from MBT-AD cannot be found then this material will require landfilling and may contain a proportion of biodegradability that would count against the Councils allowances.

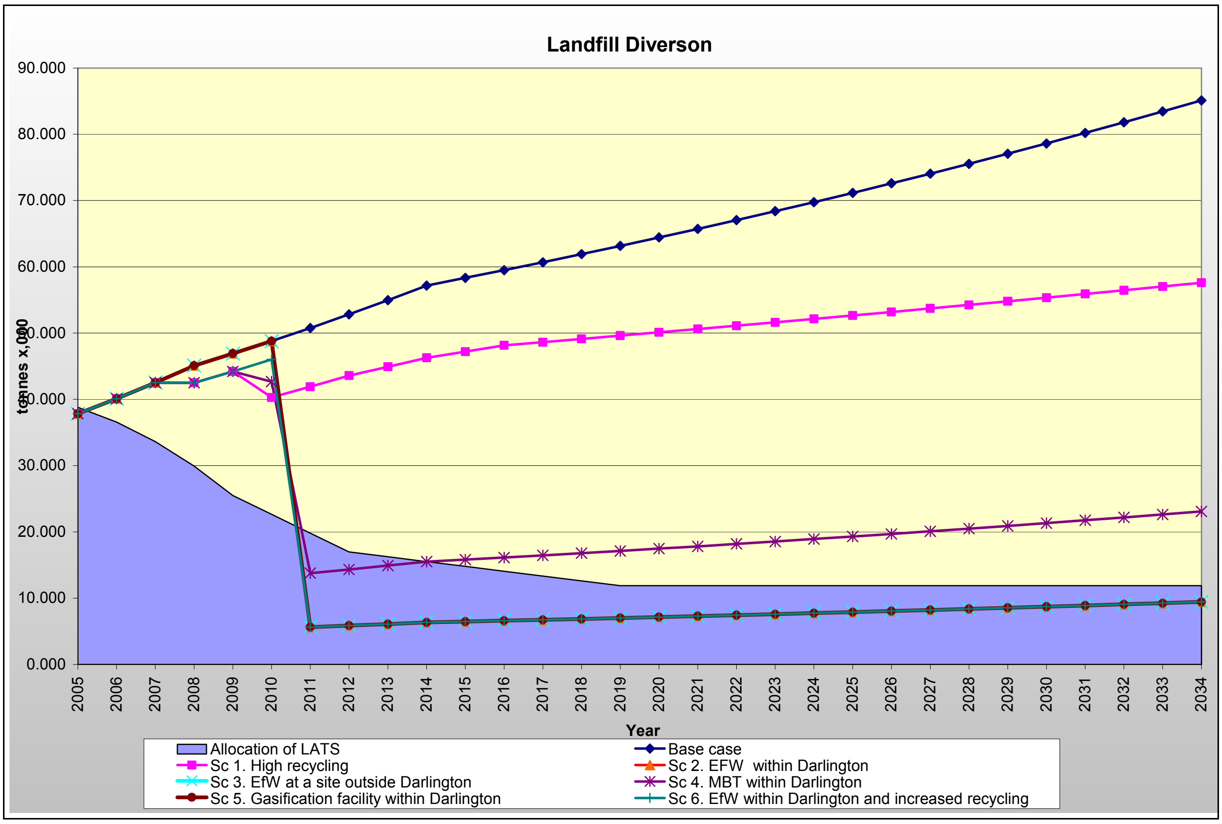

Figure A2- 2: Progress to meeting Landfill Directive BMW diversion targets

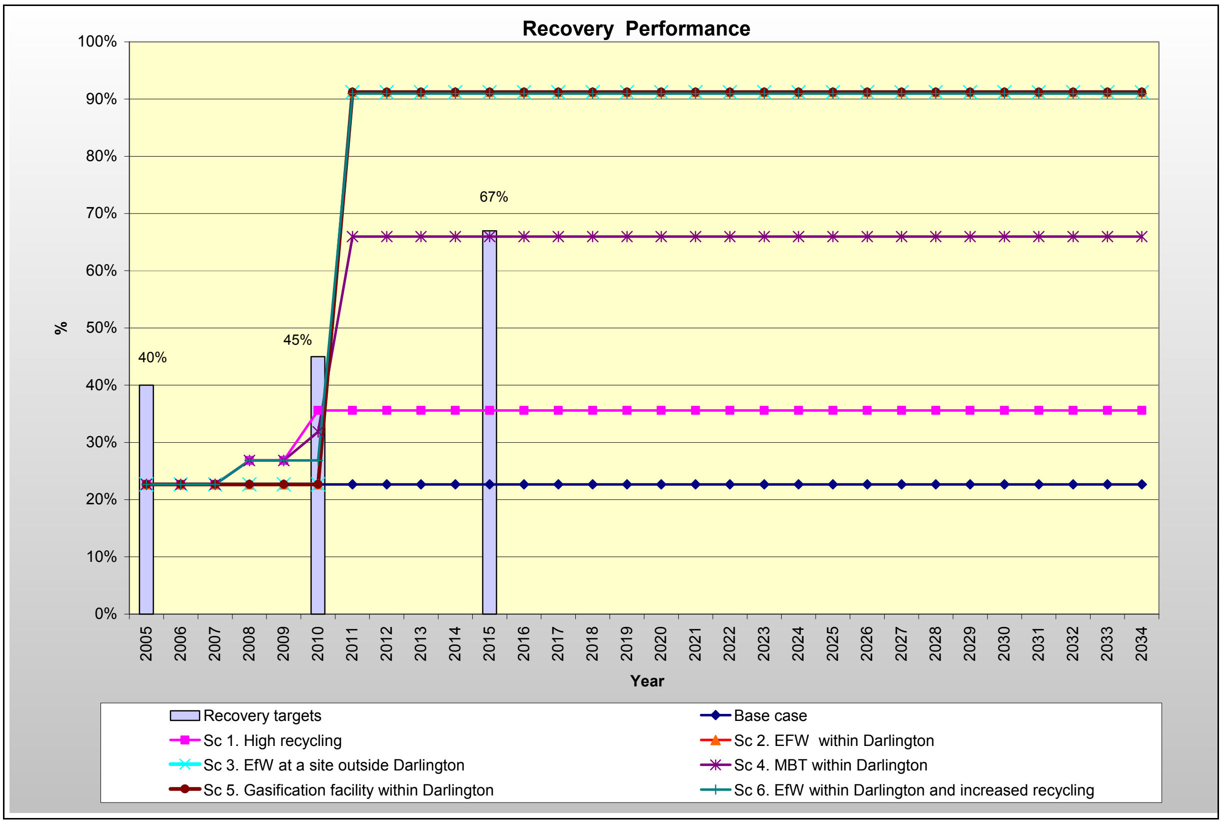

Figure A2- 3: Progress to meeting Recovery targets

Figure A2-3 shows the recovery levels for each of the scenarios modelled with all them exceeding the targets set in Waste Strategy 2000 with exception of the Base case and scenario 1. The thermal treatment scenarios are the only scenarios that meet the 2015 67% recovery target. It should be noted that non of the scenarios meet the 2010 target of 45% recovery, which is due to the treatment facilities for the residual waste becoming operation in 2011.

A2.2.1 FUTURE COSTS

Based on the mass flows developed to achieve targets and the capacities of the required infrastructure we have estimated the capital infrastructure costs for the various facilities in Table A2- 2.

Table A2- 2: Estimate of capital expenditure

Facility	Assumed Operational Date	Estimated Capital Expenditure (£m) per facility	Indicative Gate Fee (£) (excl. landfill cost)
Base Case			
Residual waste transfer & Recyclables bulking facility	2011 (120 ktpa)	3.2	11
Scenario 1 High recycling			
Residual waste transfer & Recyclables bulking facility	2011 (90 ktpa)	3	12
IVC	2011 (20 ktpa)	3.4	54
Scenario 2 EfW within Darlington			

Facility	Assumed Operational Date	Estimated Capital Expenditure (£m) per facility	Indicative Gate Fee (£) (excl. landfill cost)
EfW facility	2011 (110 ktpa)	59	76
Recyclables bulking facility	2011 (11 ktpa)	1.5	29
Scenario 3 EfW outside Darlington			
Residual waste transfer & Recyclables bulking facility	2009 (120 ktpa)	3.2	22
External EfW incinerator	2011 (110* ktpa)	N/A	60
Scenario 4 MBT-AD within Darlington			
MBT-AD facility	2011 (95 ktpa)	15	85
IVC	2011 (25 ktpa)	3.9	44
Recyclables bulking facility	2011 (10 ktpa)	1.5	29
Scenario 5 Gasification within Darlington			
Gasification facility	2011 (110 ktpa)	68	90
Recyclables bulking facility	2011 (10ktpa)	1.5	29
Scenario 6 EfW within Darlington and increased recycling			
EfW incinerator	2011 (100 ktpa)	58	83
Recyclables bulking facility	2011 (ktpa)	1.5	29

* Note: assumed to buy capacity starting in 2011 at an EfW outside Darlington with a capacity of 400kpta.

The annual revenue costs have been determined and are displayed in Table A2- 3 and also shown graphically in Figure A2- 4 for each year over the period to 2034. These show that total costs (collection and disposal) for waste management are set to rise substantially.

Table A2- 3: Revenue costs for waste management scenario

	Revenue cost for waste collection and disposal (£m/y)				
Scenario	**2010**	**2015**	**2020**	**2025**	**2030**
Base case	10.469	14.436	16.592	18.487	20.574
Sc 1 High recycling	8.567	12.834	14.184	15.007	15.873
Sc 2 Scenario 2 EfW in Darlington	10.370	8.845	9.926	10.986	12.152
Sc 3 EfW outside Darlington	11.171	9.211	10.330	11.433	12.646
Sc 4 MBT within Darlington	8.999	10.916	12.621	14.017	15.553
Sc 5 Gasification within Darlington	10.370	9.975	11.175	12.366	13.676
Sc 6 EfW within Darlington and increased recycling	10.092	9.431	10.569	11.691	12.924

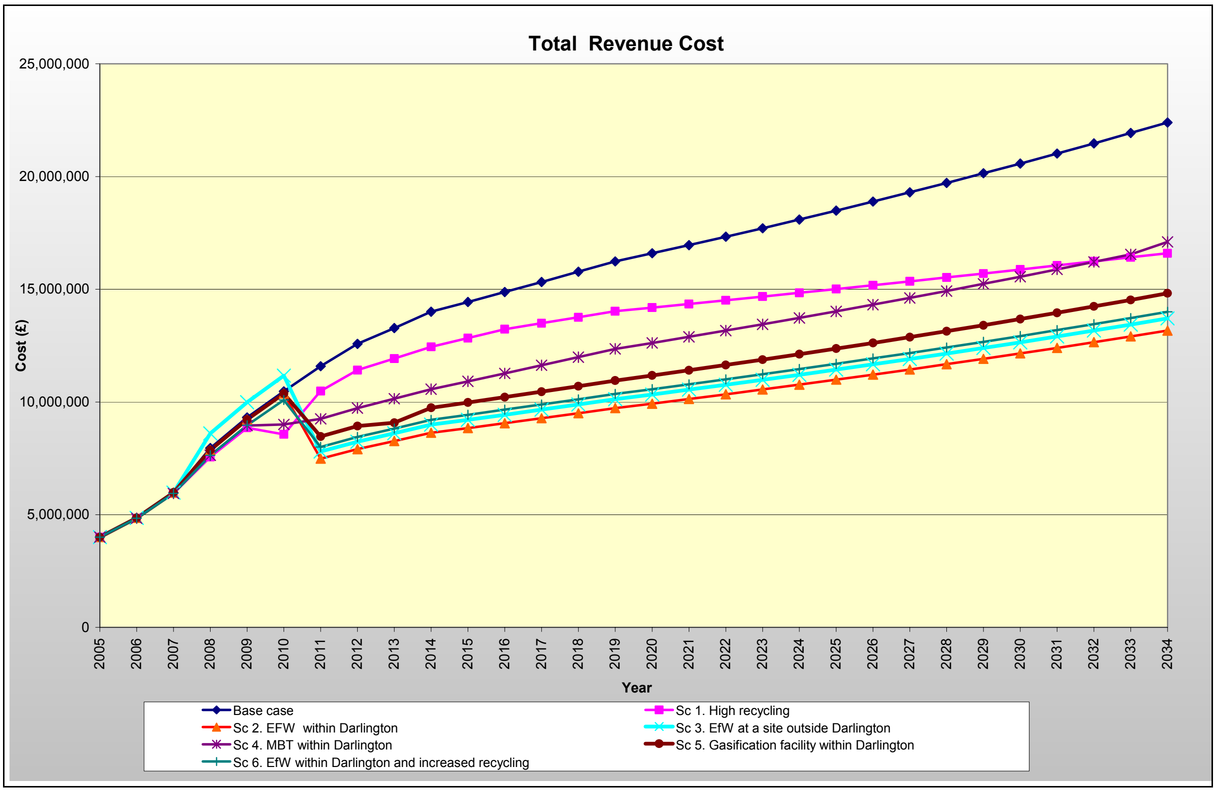

Figure A2- 4: Revenue cost projection

It is unlikely that any major waste management infrastructure for residual waste treatment could be procured and be operated before 2010. In these scenarios it has been assumed that the residual treatment facility should be operational by 2011.

Scenarios 2 (EfW within Darlington), Scenario 3 (EfW outside Darlington) and Scenario 6 (EfW within Darlington with increased recycling) have all come out at similar costs. Scenario 2 is slightly less expensive than Scenario 3 due to Scenario 3 having a high 3rd party EfW gate fee and additional transport costs. It is evident that given the scale of EfW plant required it is a fine balance between having a facility within Darlington and utilising a 3rd party outside, with the main influence being the reduced cost of a 3rd party EfW against the additional transport requirements.

The costs for gasification within Darlington are slightly higher than for EfW. It has to be considered that gasification is a new technology not yet established in the UK with large treatment capacities for residual waste. Thus, there is an uncertainty in allocating costs for such technologies and the technical risk element needs to be considered carefully within the costs. However, due to the relatively small capacity of 110ktpa, gasification may be competitive to conventional thermal treatment.

Generally, waste processing by thermal treatment is less expensive than processing waste via MBT technology due to the cost of purchasing LATs allowances if the MBT-AD compost/digestate generated has to be landfilled. Although due to the relatively small capacity of 110ktpa, MBT may be competitive to conventional thermal treatment. Overall the MBT scenario appears as the most expensive treatment option.

The Base Case and Scenario 1 (High recycling) have the highest costs as there is a need to purchase LATs permits. Scenario 1 becomes cheaper than Scenario 4 around the year 2032 due to waste minimisation initiatives reducing the amount of waste being produced. Within the modelling we have assumed £150 per tonne for such permits to be purchased or £40 per tonne income in scenarios where Darlington has a surplus of permits to sell. However, the actual value for these may differ to that value modelled, depending on market demand.

There are many unknown variables that can influence the overall cost such as:

- Waste growth rate
- Landfill tax increases beyond 2010/11
- Tradable landfill allowance values
- Changes in legislation
- Technological development

Therefore, the cost estimates provided here although based on best evidence, will be unlikely to be the cost actually experienced by the council, but the relative magnitude of the costs are likely to close to actual costs.

A2.3 Employment

The impact of the waste management scenarios on the employment within Darlington is an important factor in the choice of system that will be implemented as displayed in Table A2-4.

Table A2- 4: Performance assessment and normalised scores for employment opportunities

Employment Numbers							
	Scenario						
Facility	**Base case**	**Sc 1 High recycling**	**Sc 2 EfW in Darlington**	**Sc 3 EfW Outside Darlington**	**Sc 4 MBT-AD in Darlington**	**Sc 5 Gasification in Darlington**	**Sc 6 EfW and Increased Recycling**
Collection	33	47	33	33	45	33	42
Windrow composting	2	0	2	2	0	2	4
In-vessel composting	0	2	0	0	2	0	0
EfW	0	0	21	21	0	0	21
Gasification	0	0	0	0	0	30	0
MBT	0	0	0	0	32	0	0
HWRC	14	14	14	14	14	14	14
RTS/bulking	6	6	2	6	2	2	2
Landfill	6	5	3	3	2	3	3
Total	**61**	**74**	**75**	**79**	**97**	**84**	**86**
Normalised Score	**0.00**	**0.36**	**0.39**	**0.50**	**1.00**	**0.64**	**0.69**

Scenario 1 has more jobs than the Base Case due to more kerbside collection and an in-vessel compost facility. Gasification requires more pre-treatment than traditional EfW facilities and therefore creates more opportunity for employment. Scenario 6 (EfW and increased recycling) has more jobs than Scenario 5 (gasification) because of the additional collection service for green waste. Scenario 4 has the highest requirement for jobs due to the multistage MBT process and the additional collection service for green and kitchen waste.

A2.4 Public involvement

The role of the public in the success of any waste management system should not be underestimated and recycling schemes in particular will only be successful if the public is well informed and motivated to participate. There are also wider waste minimisation and social responsibility benefits by engaging the public in a greater awareness of their role in waste generation and its management. Thus, the extent that the waste management system (as opposed to the effects of any additional promotional activities) helps to engage the public and allows them to get involved is considered a benefit. The potential for public involvement is calculated as the sum of kerbside collection provision for dry recyclables and organics across the Council area (e.g. 100% for dry recyclables and 100% for organics).

Table A2- 4 Public Involvement

Indicators	Scenario						
	Base Case	Sc 1 High recycling	Sc 2 EfW in Darlington	Sc 3 EfW Outside Darlington	Sc 4 MBT-AD in Darlington	Sc 5 Gasification in Darlington	Sc 6 EfW and Increased Recycling
Performance Score	58,811	111,741	58,811	111,741	58,811	58,811	105,860
Normalised Score	**0.00**	**1.00**	**0.00**	**1.00**	**0.00**	**0.00**	**0.89**

A2.5 Deliverability of service solution

The deliverability of a solution is dependant on a number of factors that are considered in the following indicators:

- Maturity of technology
- Public acceptance / Achievement of planning permission
- The level of public involvement required for recycling and waste minimisation

The professional assessment scores of each scenario are presented in Table A2-5 alongside with the normalised scores.

Table A2- 5: Performance assessment and normalised scores for "maturity of technology/markets

Indicators	Scenario						
	Base Case	Sc 1 High recycling	Sc 2 EfW in Darlington	Sc 3 EfW Outside Darlington	Sc 4 MBT-AD in Darlington	Sc 5 Gasification in Darlington	Sc 6 EfW and Increased Recycling
Maturity of technology (performance score)	1.00	0.90	0.90	0.90	0.50	0.40	0.90
Public acceptance / Achievement of planning permission (performance score)	2.00	1.65	0.00	1.83	1.00	0.45	0.00
Public involvement required	137.00	350.00	137.00	137.00	306.00	137.00	302.00

Normalised Score	Scenario						
	Base Case	Sc 1 High recycling	Sc 2 EfW in Darlington	Sc 3 EfW Outside Darlington	Sc 4 MBT-AD in Darlington	Sc 5 Gasification in Darlington	Sc 6 EfW and Increased Recycling
Maturity of technology (performance score)	1.00	0.83	0.83	0.83	0.17	0.00	0.83
Public acceptance / Achievement of planning permission (performance score)	1.00	0.83	0.00	0.91	0.50	0.23	0.00
Public involvement required	0.61	0.00	0.61	0.61	0.13	0.61	0.14

On average the Base Case is the easiest and most reliable solution as it is landfill based, which is a reliable and deliverable technology. On a technical and commercial basis established systems such as EfW are well proven and reliable and can be delivered by the industry although the problem of finding a market for CHP has to be considered. Newer technologies such as gasification are less well proven and as such have greater risk of not being delivered appropriately in the UK conditions. The technical difficulties of delivering gasification and the risk of finding markets for the RDF and compost/digestate generated by the MBT-AD bring about lower scores.

Public acceptance is also an important factor to consider in applying for planning permission. EfW facilities are likely to have greater difficulty in gaining planning permission due to their size and given the public opposition to such facilities. New advanced thermal treatment technologies such as gasification are more likely to be accepted by the public, as is the MBT-AD technology.

The rate of waste minimisation and recycling depends on the level of public involvement. The level of involvement is the same for all scenarios except Scenarios 1, 4 and 6, which have the highest levels of public involvement due to the expansion of recycling to include organic waste collections. The value for Scenarios 1 and 4 are slightly higher as the model assumes that a kitchen waste collection service can be expanded to additional households where a green waste only collection is not suitable. In addition Scenario 1 also requires public awareness to achieve the targets for waste minimisation and increased performance on the dry kerbside recyclate collection.