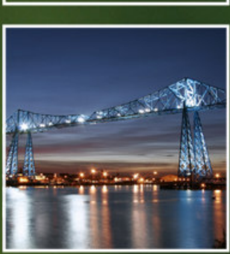
Tees Valley Joint Waste Management Strategy

Supporting Document – Waste Treatment

June 2008

HARTLEPOOL BOROUGH COUNCIL





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1. Introduction

1.1 Background

The Tees Valley options appraisal process includes options which have an alternative residual waste treatment options. In addition to this the introduction of a food waste collection (either source segregated or combined with a green waste collection) if considered to be the preferred option would require a suitable facility for processing. This document supports the Headline Waste Strategy and the options appraisal process by providing information on waste treatment technologies.

The Tees Valley Authorities have a number of waste treatment options available for the long term management of municipal waste. These can be summarised into the following options from Defra Guidance[1]

- Recycling;
- Mechanical Sorting and Processing;
- Biological Treatment;
- Mechanical Biological Treatment;
- Advanced Thermal Treatment;
- Energy from Waste.

1.2 Baseline

The Tees Valley Authorities currently remove recyclable and green waste compostable materials through front end source segregated collection systems with the residual waste stream being sent to either the Energy from Waste (EfW) facility or directly to landfill for disposal. Currently the waste stream that is disposed of to landfill is residual waste from Darlington that is not part of the EfW contract, the waste stream that is non-conforming waste for the EfW facility or has to be diverted from the EfW facility through either planned or unforeseen shutdown.

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[1] Options for the Diversion of Biodegradable Municipal Waste from Landfill, July 2005

A procurement exercise for green waste composting was carried out during January – June 2007, resulting in there being four approved suppliers of this service, of which two are commercial windrow composting operations and two are on farm schemes.

The treatment of the green waste stream is currently through a number of open windrow and on farm facilities that are predominantly located around the Tees Valley. These facilities are unable to process any kitchen waste since they do not meet the requirements of the Animal By-Products Regulations.

The source separated kerbside collected recyclate stream is predominantly currently collected and delivered to processing facilities under contract, with the exception of Darlington Borough Council that provides its own recycling collection service. The processing facilities are located within the Tees Valley and the neighbouring Authorities and are used to bulk the separated waste streams for onward transportation to recycling and reprocessing facilities. In addition to the contracted kerbside collection service Redcar and Cleveland and Hartlepool Authorities deliver a mixed plastics and cardboard collection with initial sorting carried out at the Authorities own depots.

Reprocessing facilities used for the source separated collected Household Waste Recycling Centre (HWRC) waste, the bring site waste and the bulked source separated kerbside collected materials are located throughout the North East Region and beyond, influenced by the availability of processing capacity. Table 1.1 lists some of the reprocessing facilities used by the Authorities within the sub-region.

Table 1.1 Reprocessing Facilities

Material	Facility
Paper and Cardboard	Bridgewater Mill, Cheshire
	Rigid Paper Mill, Selby
	Riverdale Paper, Durham
Glass	Glass Recycling UK (GRUK)
Ferrous Metals	European Metals Recycling (EMR), Hartlepool
Non-Ferrous Metals	Thompson’s Scrapyard
	Corus

Material	Facility
Wood	UK Wood, Wilton
Green Waste	SITA
	A&E Thompson
	J. Campbell, One Holmes Farm
	Agrivert
Textiles	Kettering Textiles
Mattresses	J&B Recycling, Hartlepool
Plastics	Alternative Waste Solutions
	UK Resource Management
	Repak, Leeds

Bulky waste collections have traditionally attained low levels of recycling within the Tees Valley. All of the authorities remove some items from this waste stream through identification of waste streams prior to collection, including fridges, Waste Electrical and Electronic Equipment (WEEE), scrap metal and green waste. Hartlepool, Middlesbrough, Redcar and Cleveland and Stockton on Tees Borough Councils are currently attaining levels of recycling in the region of 40% through a trial with a sub-regional recycling company. The remainder of the bulky waste stream is sent to the EfW for recovery or directly to landfill.

Over 50% of the total residual municipal waste stream, equating to 197,600 tonnes, was taken to the Energy from Waste (EfW) facility at Haverton Hill in 2006/07. This facility is operated by SITA Tees Valley Ltd, a joint venture company of SITA UK and Hartlepool, Middlesbrough, Redcar and Cleveland and Stockton Authorities. The facility has been operational since May 1998 and recovers energy from the municipal waste stream which would otherwise be disposed to landfill. The Hartlepool, Middlesbrough, Redcar and Cleveland and Stockton Authorities are committed to taking their waste to this facility until 2020, ensuring that energy is recovered from a proportion of the residual waste stream.

The Haverton Hill incinerator is a large scale moving grate mass burn facility with electricity generation. The plant has two streams each capable of processing up to 20 tonnes of waste per hour. The combustion is controlled such that the temperature of the flue gases is at least

850^{o}C for two seconds to maximise the destruction of organic materials, including dioxins. The hot flue gases pass through a boiler, generating steam which then drives the turbine unit for electricity generation. The plant produces on average 20 megawatts of electricity per hour on full load and is operational 24 hours a day and 7 days a week. This is enough energy to supply 40,000 homes with power. The flue gases are passed through flue gas abatement plant to remove contaminants with the incineration off-gases continuously monitored and spot samples taken.

Adjoining the EfW is an Incinerator Bottom Ash (IBA) recycling plant that processes the bottom ash to remove metals with the remainder of the ash being classified for use as a replacement for virgin aggregates in the construction industry. This minimises the requirement for any of the by-product materials from the process to be landfilled. The remaining EfW residue that can not be recycled is taken to a Hazardous Waste deep disposal facility in Cheshire.

The Hartlepool, Middlesbrough, Redcar and Cleveland and Stockton Authorities currently have a contract to deliver at least 180,000 tonnes of their residual waste stream to the Haverton Hill EfW facility until 2020.

The remainder of the residual waste stream, about 69,900 tonnes of household waste was disposed to landfill in 2006/07. These landfills are situated within and outwith the Tees Valley. The landfills are operated and controlled under a Pollution, Prevention and Control Permit to ensure a high standard of environmental protection and in order to minimise the potential harm to human health. The landfills are fully complaint with the requirements of the European Landfill Directive and have been designed to capture any landfill gas generated. This landfill gas is used to generate energy on the site where feasible.

As a result of the energy from waste contract, currently only 22% of the household waste produced is landfilled.

2. Facilities

2.1 Transfer Stations

Transfer Stations can be used to improve transport efficiencies by bulking material collected directly from householders or other facilities at a central location prior to onward transportation. Savings can be made by reducing the time that collection vehicles travel between the end of a route and a treatment or disposal facility. Transportation between a Transfer Station and a treatment or disposal facility can be made more efficiently using vehicles that carry a larger load. They can also provide some limited opportunity for material segregation.

2.2 Material Handling Facilities/ Transfer Facilities for Recycling

Materials may be collected at the kerbside from householders either source separated, or as a mixed recyclate stream usually using a wheeled bin. Recycling facilities are also provided to householders through HWRCs and bring banks. Material handling facilities may be required for the bulking of source separated materials to allow for efficiencies to be made in the transportation of recyclate for onward processing. At their simplest these facilities incorporate simple storage bays where individual materials are tipped for bulking prior to onward transportation to reprocessors.

2.3 Mechanical Sorting and Processing

2.3.1 Introduction

This report looks at three different types of mechanical sorting and processing facilities:

- Materials Recycling Facilities (MRF) – for the processing of partially segregated or co-mingled recyclates;
- Dirty MRF – for the processing of the residual waste stream to recover additional value;
- Bulky Waste Sorting Facilities – to increase levels of reuse and recycling from this waste stream which may be partially separately collected.

2.3.2 Materials Recycling Facilities (MRF)

Mechanical sorting and processing techniques are used, to some extent, in conjunction with most waste treatment technologies described within this section. Mechanical techniques may be used to process segregated, or co-mingled recyclates to extract recyclable material, remove contamination and bulk recyclable materials.

Mechanical methods may be combined with manual sorting in the form of picking stations where materials are hand picked and sorted from a waste stream. Levels of contamination will be primarily affected by the methods of collection from householders – i.e. co-mingled wheeled bin collections or kerbside sort through a series of boxes and bags where contamination is normally left at the kerbside.

Figure 2.1 Recycling and Mechanical Sorting and Processing

Table 2.1 Performance Indicators for Mechanical Sorting and Processing

Mechanical Sorting and Processing	
Capacity (ktpa)	20 – 120
Land Take (hectares)	1 - 3
Average Capital costs (£m)	10 - 15
Est. Gate fee (£/t)	15-25
Fundable	YES
% Recycled	10%

2.3.3 Dirty Materials Recycling Facility (MRF)

Mechanical techniques may be used to process mixed MSW or segregated, co-mingled recyclates to:

- Extract recyclable material;
- Separate out an organic rich fraction (high in BMW) for biological processing; or
- Produce a fraction with high calorific value (good combustion properties) which may be used as a fuel.

Mechanical sorting and processing techniques can be used to separate out recyclable materials from a mixed waste stream. This type of facility is normally referred to as a Dirty Materials Recycling Facility or Dirty MRF. These types of facilities can be used to attain additional levels of recycling and/ or a compostable fraction from the residual waste stream. A Dirty MRF can consist of a series of different sorting and processing stages, and is therefore similar to a standard MRF. However, levels of recycling will not be as great with a poor quality recyclate that may not attain Publicly Available Standards and the residual waste proportion will be significant.

The main advantage of a Dirty MRF is the segregation of further recyclable materials from the residual waste stream, with no associated additional collection costs. The levels of recycling attained are not affected by the participation of the public, rather by the effectiveness of the facility in removing materials. However, with the introduction of kerbside source separated collections the potential levels of recyclate within the residual waste stream may not justify the additional effort to remove this stream.

2.3.4 Bulky Waste Sorting Facility

Mechanical processing and recovery facilities may be used to increase levels of reuse and recycling from the bulky waste stream or indeed the residual waste stream collected at HWRCs. The success of these facilities may be influenced by the methods of collection employed, i.e. the provision of separate collections from the general household waste stream and the collection using suitable vehicles that do not compact the waste streams. These types of services may also be enhanced through improved routing of these services and allocation of collections to rounds based on material type. The potential for bulky waste collection services to be provided by the third sector is explored more fully in the Supporting Document on Waste Awareness and Minimisation.

The actual processing of this waste stream may be somewhat labour intensive and the recycling rate achieved will be a factor of the amount of effort in this activity. The provision of specialist facilities for the recycling of specific waste streams may also assist in achieving higher levels of recycling, in particular facilities that may recycle mattresses or carpets. These types of facilities are again explored more fully in the Waste Awareness and Minimisation document.

2.4 Biological Treatment Facilities

Biological treatments can be divided into two processes:

- Aerobic;
- Anaerobic

Composting is the process in which biodegradable material is broken down in the presence of oxygen by micro-organisms resulting in elevated process temperatures, the production of carbon dioxide, water and a stabilised residue, known as compost. A high degree of stabilisation can generally be achieved in 3-6 weeks; however further maturation or 'curing' is normally carried out. For composting to occur in an optimum manner and increase the value of the final product, five key factors need to be controlled; temperature, moisture, oxygen, material porosity or consistency and the Carbon: Nitrogen ratio. There are various methods of achieving this from simple windrow composting (commonly used for green waste) to in-vessel processes

where air is introduced to the waste within a container. Windrow composting is not suitable for catering waste as it is unable to satisfy the requirements of the Animal By-Products Regulations (ABPR) and hence composting as a residual waste treatment implies the use of more sophisticated in-vessel systems. Windrow composting is, however suitable as the second stage of an ABPR compliant system and hence is included as an option within this project.

Figure 2.2 In Vessel Composting

Table 2.2 Performance Indicators for In Vessel Composting

In Vessel Composting	
Capacity (ktpa)	20 – 120
Land Take (hectares)	1 – 3
Average Capital costs (£m)	10 - 15
Est. Gate fee (£/t)	25 – 40
Fundable	YES
% Recycled	4%
% Recovered	38%
% active Landfill	46%
% inactive Landfill	12%

Anaerobic Digestion (commonly referred to as AD or methanisation) is the process by which the biodegradable fraction of municipal waste is broken down in the absence of air to create biogas and a stabilised sludge or ‘compost’. The process has many similarities with composting and is one method of treating Category 3 Animal By-Products prior to the spreading of this material on agricultural land. The main difference between aerobic and anaerobic treatment is the type of bacteria acting within the degradation process. In the case of AD, the process produces a biogas consisting of mainly methane (CH_4) and a lesser amount of carbon dioxide (CO_2). This gas can then either be separated and combusted or burnt in a combined heat and power generator. This has the added advantage of being able to feed heat and power back into what is a high-energy consumption process.

Figure 2.3 Anaerobic Digestion

Table 2.3 Performance Indicators for Anaerobic Digestion

Anaerobic Digestion	
Capacity (ktpa)	20 – 100
Land Take (hectares)	3 – 6
Average Capital costs (£m)	24
Est. Gate fee (£/t)	35 – 50
Fundable	?
% Recycled	4%
% Recovered	38%
% active Landfill	46%
% inactive Landfill	12%

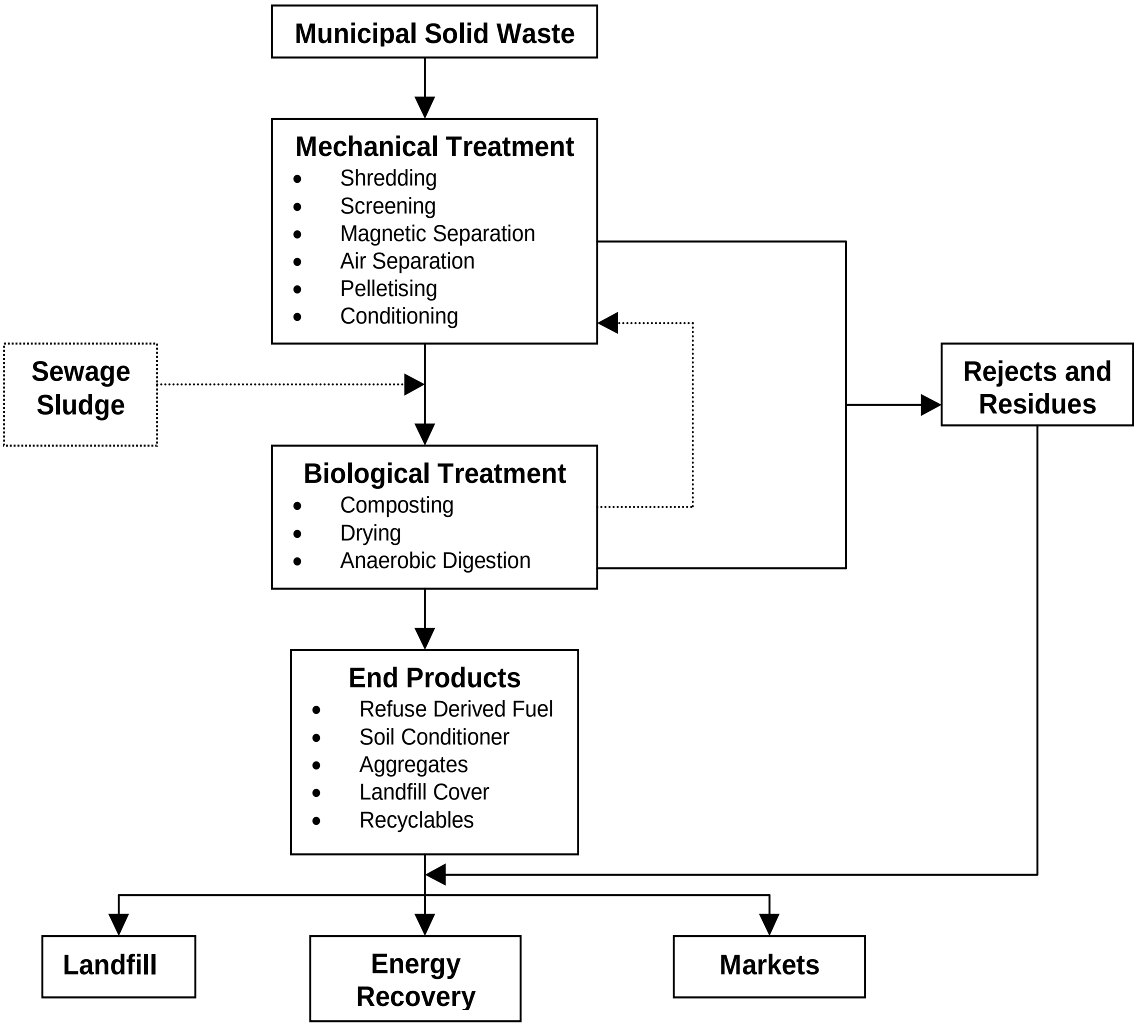
? = Not currently operating for MSW in the UK

2.5 MBT: Mechanical and Biological Treatment

Figure 2.4 MBT Technology

MBT is a general term for treatment systems consisting of a mechanical sorting system with an adjacent biological treatment facility. Systems can vary in terms of the degree of mechanical sorting and the type of biological process applied. Consequently the materials sorted from the waste and the end products of the process can vary depending on the separation process employed. MBT is predominantly a volume-reducing process recovering recyclable materials from MSW and biologically treating the biodegradable component of the waste. Biological processes in use can be aerobic (composting or drying) or anaerobic (digestion) and produce a variety of end-products including stabilised biodegradable material, compost, refuse derived fuel (RDF) as well as the extracted recyclable material. Generally the mechanical phase is placed at the front-end of the MBT process although some systems operate end-of-process sorting.

Figure 2.5 MBT Overview



MBT processes can be split into a number of generic types:

- Bio-stabilising RDF plants;
- Aerobic compost splitting plants;
- Anaerobic digestion (AD) splitting plants.

Bio-stabilising plants remove recyclates and then convert the majority of MSW to an RDF. This process has the lowest capital costs, medium operating costs but also the least flexibility with the range of products that it can produce. Technology suppliers include Herhof and Ecodeco.

Aerobic composting splitting plants produce a drier RDF with less biogenic material than a bio-stabilising plant, compost, residues and recyclates. This process has medium capital costs, medium operating costs and a medium level of flexibility with the range of products that it can produce. Technology suppliers include Horstmann, VKW and Linde.

The Premier Advanced Recycling Centre (PARC) technology is operational in the North East to process the residual MSW stream and is part of Defra's New Technologies Programme. This technology is Aerobic Digestion through a series of composting compartments within towers. MSW is firstly shredded, with any metals removed by overband magnets. Waste is then loaded into the top of the composting tower, which consists of three composting compartments. Each compartment contains a large three limbed aeration and mixing assembly. The waste drops down between each level with careful temperature control and aeration. After six days the material has been stabilised and composted, and is processed further using trammels, air-knives, ferrous and eddy current separators.

Anaerobic Digestion (AD) splitting plants produce a drier RDF with less biogenic material than a bio-stabilising plant, a cleaner compost than an aerobic composting splitting plant, residues and recyclates. The process also produces a biogas that can be used in well-established technology for the recovery of energy. This process has the highest capital costs, the lowest operating costs, and a medium level of flexibility with the range of products which it can produce. Technology suppliers include Linde.

Table 2.4 MBT Performance Indicators

Mechanical Biological Treatment	
Capacity (ktpa)	30 – 120
Land Take (hectares)	3 – 6
Average Capital costs (£m)	16 – 20
Est. Gate fee (£/t)	35 – 55
Fundable	YES
% Recycled	14%
% Recovered	25%
% active Landfill	50%
% inactive Landfill	11%

2.6 Autoclave

Autoclave facilities, also known as Mechanical Heat Treatment (MHT), involve the treatment of mixed municipal waste under high temperatures with steam or hot water[2]. This process recovers clean recyclate (metals, glass and plastics), degrades the organic waste stream and produces a sterilised output. Individual batches of waste are treated in vessels during individual treatment cycles. These cycles are normally of short duration during which time materials are broken down and separated by material type.

There are two distinct processes that fall within this category of facility:

- Steam Autoclaves;
- Hot drum expanders.

[2] http://www.environment-agency.gov.uk/wtd/679004/679032/679093/?version=1&lang=_e

Table 2.4 Autocaves Performance Indicators

Autoclave

Capacity (ktpa)	30-120 (modular)
Land Take (hectares)	1-4
Average Capital costs (£m)	20-30 (technology and size dependant)
Est. Gate fee (£/t)	Projected 30-45
Fundable	?
% Recycled	15%
% Recovered	64%
% Landfill	21%

The sterilised fibre output is a cellulose floc that may be used in recycling to make fibreboard or may be thermally treated as a Refuse Derived Fuel (RDF). Securing markets for the cellulose floc material is important in ensuring high levels of diversion from landfill and will influence the overall environmental impact of the technology.

Figure 2.6 Autoclave Process

2.7 Advanced Thermal Technologies (ATT)

This term is used to describe those technologies in which the various sub-processes that occur within conventional combustion are separated spatially, often with the intent of achieving a greater degree of control of the overall combustion process. The sub-processes comprise:

> **Pyrolysis:** The thermal degradation of material to produce char, oils and fuel gas. Pyrolysis usually occurs in the absence of oxygen and requires heat to provide a temperature in the range of 400-800ºC to effect the thermal degradation.
>
> **Gasification**: Uses a controlled amount of oxygen and/or steam to break down the long chain hydrocarbons in the waste to produce gases with an energy value such as hydrogen, carbon monoxide and methane.
>
> **Oxidation**: The combination of oxygen (usually supplied by a stream of air) with the products of pyrolysis and gasification resulting in the release of thermal energy.

Some suppliers of advanced thermal technologies promote the concept that they can extract the gasifier product gas and use it as a feedstock for processes producing materials such as hydrogen, methanol or ammonia. Whilst this is commonplace in the petro-chemical industry where the feedstock (crude oil) is homogenous, it is not yet a proven concept on waste pyrolysis-gasification processes.

At present, due to the additional complexity, cost and technical risk associated with a “power” gasification system, many suppliers of advanced thermal technologies tend to couple their technology with a conventional steam cycle.

This helps sanitise and reduce residual MSW to a 'flock' like material, with metals and glass partially cleaned for extraction as recyclables, but may melt plastics making these more difficult to recycle. The residual material may be thermally treated as a type of RDF.

Figure 2.7 Gasification Overview

Table 2.5 Gasification/ Pyrolysis Performance Indicators

Gasification/ Pyrolysis	
Capacity (ktpa)	60 – 120
Land Take (hectares)	4 – 6
Average Capital costs (£m)	70 - 90
Est. Gate fee (£/t)	50- 70
Fundable	?
% Recycled	3%
% Recovered	30.5%
% active Landfill	1%
% inactive Landfill	65.5%

? = Not currently operating for MSW in the UK

2.8 Energy from Waste Thermal Technology

The term “thermal” is commonly used to describe incineration processes in which the waste is subject to a combustion process. The combustion relies on the intimate mixing of the waste stream with air (which provides oxygen) at a high temperature. The combustible material is oxidised and, in the process, releases energy (heat) and the products of combustion in the form of gases. The incombustible material is removed from the process as an ash.

A number of different types of furnace are possible – the three principal types being mass-burn grate-based combustion, kilns and fluidised beds. The characteristics of grates and kilns a broadly similar, in that waste is introduced at the top of the grate or kiln and moves down the grate or kiln as it burns. Fluidised beds are different in a number of respects:

- They require a more sophisticated fuel feed system with a more homogenous feedstock (which may not be a problem for heavily pre-treated waste);
- They can incorporate in-bed reagents for control of pollutant emissions;
- They can have inherently lower NO_x and CO emissions;
- They can be sensitive to load variations.

The system design, and hence cost is influenced by the types and volumes of waste being treated. The calorific value (CV) of the waste determines the operating temperature within the combustion chamber. Typically unsorted municipal waste can be sufficiently mixed to provide a CV of 8-12 mJ/kg. Where materials are removed from the waste stream through front end recycling initiatives, the CV of the waste changes. For example, a waste stream containing a high plastic content will have a higher CV than that of a waste stream containing largely kitchen waste, leading to a far greater combustion temperature. This means that that the facility must accept less waste, in order to prevent damaging the combustion chamber. Fluctuations in CV causes control problems within a thermal process, leading to costly additional engineering and gas treatment systems.

The thermal efficiency of an EfW plant is an important consideration with this type of technology, distinguishing whether a facility is a disposal or a recovery operation and impacting on the overall carbon balance. The thermal efficiency of incinerators may be less than the efficiencies obtained using a standard oil fired power station whereas the incorporation of Combined Heat and Power technology will significantly improve the efficiencies to in excess of twice that of a standard power station.

Figure 2.8 Haverton Hill Energy from Waste Facility

Table 2.6 Energy from Waste Performance Indicators

Energy from Waste	
Capacity (ktpa)	60 – 300
Land Take (hectares)	4 – 6
Average Capital costs (£m)	28
Est. Gate fee (£/t)	45 – 60
Fundable	YES
% Recycled	2%
% Recovered	75%
% active Landfill	0%
% inactive Landfill	23%

3. Recommendations for Tees Valley

3.1 Current Recommendations

3.1.1 Hartlepool, Middlesbrough, Redcar and Cleveland and Stockton Authorities

Hartlepool, Middlesbrough, Redcar and Cleveland and Stockton Authorities are currently under contract to provide SITA with at least 180,000 tonnes per annum MSW for processing at the Haverton Hill EfW. This ensures that the Authorities recover value from the residual waste stream and divert waste from landfill. The SITA contract runs until 2020 and offers the Hartlepool, Middlesbrough, Redcar and Cleveland and Stockton Authorities the opportunity to meet Landfill Allowance targets without further processing. Of the 40,000 tonnes of residual municipal waste disposed to landfill, a small proportion of this will continue to have to be landfilled because it doesn't conform to the requirements for incineration.

As shown in chapter 2, most treatment options have a minimum operating capacity and where this is above the 40,000 tonne potentially available, the procurement of such a facility cannot be considered further. For example, further energy recovery through the use of advanced thermal technologies is not feasible at this level. This leaves the Authorities with Digestion Technologies, which would only be suitable for the biodegradable fraction of the remaining waste, Mechanical, Biological Treatment, where a further fraction of the waste could be recovered, but a portion would remain for energy recovery or biological treatment or an Autoclave facility that would recover recyclables with a cellulose floc material for energy recovery or recycling. However, it is recognised that the Authorities may have merchant plants available which would allow relatively small amounts of material to be sent to these facilities for recovery.

The requirement for Digestion Technologies will be informed by future decisions regarding source separated Food Waste Collections. The Authorities have not committed to the introduction of these services at this time and therefore this is not a requirement.

The decision to include further mixed waste treatment for these Authorities then lies with the price or gate fee, and comparison of this against the value to be gained by selling the additional LATS credits. Further options for treatment need to be evaluated against the value the Authorities are able to obtain for Allowances. The current gate fee through the SITA contract is

however much lower and with no maximum tonnage on the contract, this currently remains the most financially viable option.

However, it is recognised that the proposed development of an Autoclave facility within an Environmental Industries Park within Redcar and Cleveland may provide a significant opportunity to the neighbouring Authorities. This may be of particular interest to Redcar and Cleveland as they are located at the greatest distance from the Haverton Hill facility. Consideration of the use of this facility may remain a financial one and a balance between, presumably, higher gate fees and higher haulage costs. However, higher haulage costs may also be minimised through the provision of Transfer Station facilities. Consideration of alternative treatment facilities using a Life Cycle Assessment tool WRATE (Waste Resources Assessment Tool for the Environment) is included within the Supporting Document - Options Appraisal.

3.1.2 Darlington Borough Council

In contrast Darlington Borough Council (DBC) currently relies on landfill for the disposal of their residual waste, recovering little value from this waste stream. DBC has recently awarded a contract for the management of all their collected wastes. This new contract will be operational by 2009. The contract was procured under an output basis specification, whereby DBC advised bidders of their requirements in terms of meeting recycling, composting and landfill diversion targets. This Strategy does not intend to comment on the procurement process but recognises that DBC has committed to procuring additional treatment capacity allowing them to divert waste from landfill and attain targets.

The potential benefit of alternative treatment facilities for DBC are considered separately using the WRATE tool as mentioned above. The results of this modelling are contained within the Supporting Document - Options Appraisal. The output of the WRATE modelling was not intended to inform the procurement process in terms of specific technologies, rather to provide a high level indication of the potential environmental benefit that may be attained through the diversion of waste from landfill.

3.2 Looking Beyond 2020

The current contract with Sita and the new Darlington contract will both cease in 2020. The cessation of these contracts within the same time period will allow the Authorities to consider a joint Tees Valley wide contract for the residual waste stream. The availability of processing capacity beyond 2020 to ensure the recovery of waste and diversion of materials from landfill is a significant challenge for the Tees Valley Authorities. The Tees Valley Authorities have identified the requirement to commence the procurement of new treatment capacity in 2015 to ensure this is in place by 2020. The identification of a preferred technology at this time is problematic for a number of reasons, the most important of which are outlined below:

- Changes in legislation and targets – this will continue to steer the direction of future waste strategies within the Tees Valley;
- Changes in waste composition – this will be affected by front end services removing recyclate from the residual waste stream;
- Changes in technology available – these are likely to be considerable as technology efficiencies improve and test facilities come on stream;
- Changes in economics of waste – this may affect the affordability of technologies or collections;
- Changes in waste growth – public attitudes and fiscal incentives may significantly affect the overall waste arisings;
- Changes to relationships with the Private Sector – as both providers of facilities and also as potential customers.

The success of the current joint contract, in terms of both value for money and meeting targets, demonstrates that the Tees Valley Authorities should seek ways to work together to procure appropriate facilities for waste treatment and resource recovery beyond 2020. The preferred technology type is not identified in this document. However, it is considered that Energy from Waste will remain a viable option for the partner Authorities as it has proven to be an acceptable technology type within the region. The incorporation of Combined Heat and Power technology would provide greater thermal efficiencies.