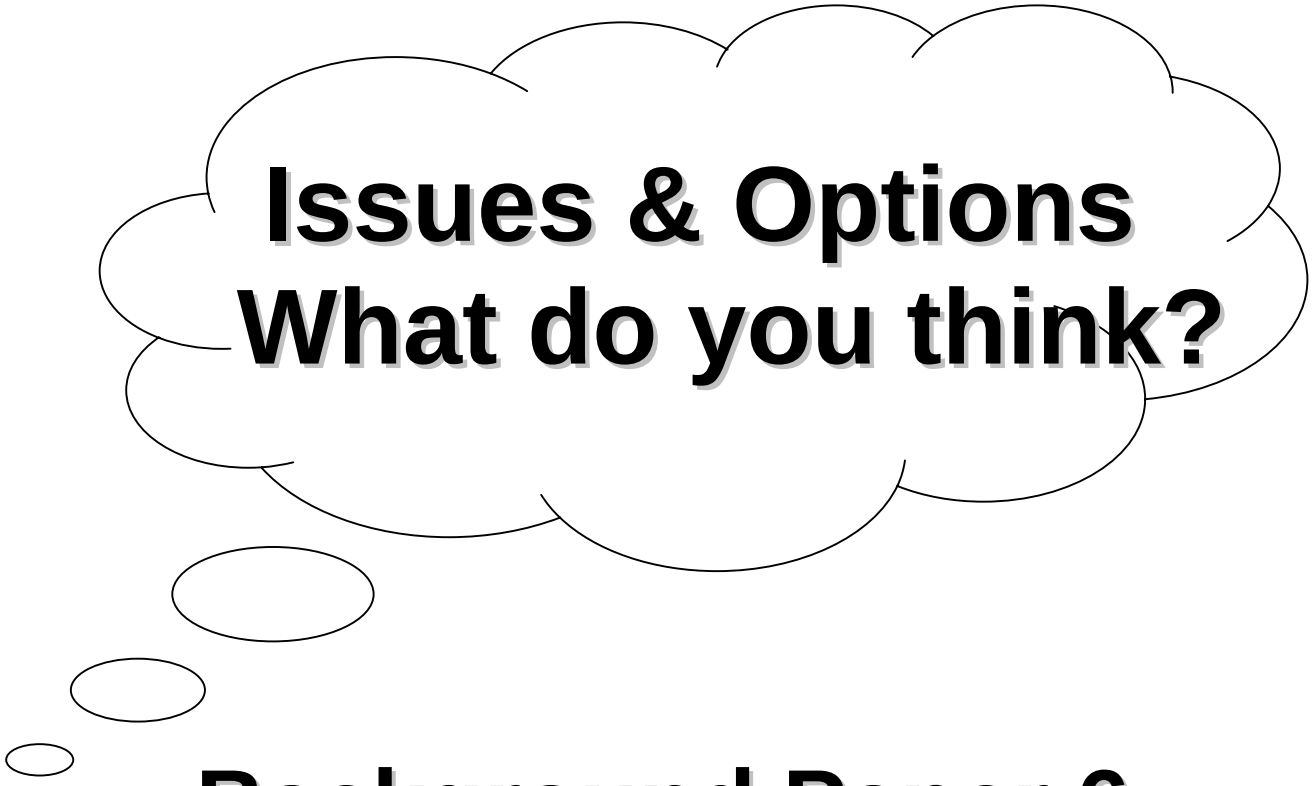
Nottinghamshire & Nottingham Waste Core Strategy & Development Control Policies



Issues & Options What do you think?

Background Paper 6: Other types of Energy Recovery

Nottinghamshire County Council

Nottingham City Council

1. Introduction

1.1 Nottinghamshire County Council and Nottingham City Council are preparing a new set of waste planning policies for Nottinghamshire. These will replace the existing waste local plan and will be part of both councils' new local development frameworks. The new waste policies will be set out in three separate documents. The first of these, the waste core strategy and the development control policies are being prepared together and will set out future requirements, suitable location criteria and appropriate environmental controls. A site-specific document will follow.

1.2 As part of preparing these new planning policies for waste, the County Council and City Council have produced a series of background papers to provide more detail on the 'Issues and Options' consultation exercise (see below).

Purpose of this Background Paper

1.3 This background paper looks at different methods of recovering energy from waste except incineration, which is covered separately in Background Paper 5. Other papers look at options such as recycling, composting and landfill. Each paper sets out the number, location and capacity of current facilities, likely future needs, and the main planning issues in terms of site location and environmental controls. The general policies and principles of waste management are set out in Background Paper 1. Background Paper 2 provides a basic assessment of how much waste is produced in Nottinghamshire, how it is managed and possible future trends.

Further information

1.4 For further information, copies of other background papers or to join in the Issues and Options consultation please contact the Minerals and Waste Policy Team at the County Council or the City Development Team at Nottingham City Council. Details are shown on the back cover.

Please note that, unless stated otherwise, all references to Nottinghamshire within this paper include the City of Nottingham.

2. The Process, Site Requirements, and Environmental Impacts

Why do we need Energy Recovery?

2.1 Waste that is sent to landfill is a lost resource. If materials cannot be recycled or composted then the next best option is to try and recover value from them. Burning waste, or converting it into gas or 'refuse derived fuel'[1] generates energy which can be used to provide heat and power to nearby homes and businesses. This helps to reduce landfill and offsets the need to use fossil fuels.

What is Energy Recovery?

2.2 The most common form of energy recovery is incineration (see Background Paper 5) where waste is burned at high temperatures to produce electricity. There are however other ways of recovering energy from waste (see Panel 1). The two basic techniques involve either thermal or biological treatment. Thermal methods such as gasification and pyrolysis both heat the waste in varying amounts of oxygen so that it is converted into a gas rather than being burnt. Biological methods such as anaerobic digestion and mechanical biological treatment rely on the biodegradable nature of the waste and the introduction of bacteria to breakdown the waste to produce a gas or a dried organic material, which can be burned.

2.3 Both pyrolysis and gasification generally require some pre-sorting or treatment of the waste. This can involve shredding or compacting the waste but may also be linked to the separation of recyclables prior to processing. The remaining feedstock is then processed. With gasification the waste can be suspended in a 'fluidised bed' of hot sand which mixes the waste or it can be passed along a moving grate. Both processes leave an ash residue. Pyrolysis passes waste into either a rotating drum or a heated tube where it dries and decomposes into gas and a solid residue known as char. In most cases, the exit gases carry off some particulates of ash and carbon and this 'flue-gas' must be cleaned prior to discharge from the stack.

2.4 Anaerobic digestion also requires pre-treatment of the waste to separate out the organic materials suitable for digestion. The organic waste is delivered to a reception building where it is then transferred to large silo-like digestion tanks. The waste is then 'fermented' within the digester to produce biogas, which is burned to generate heat and power. The residue is usually composted or used as liquid fertiliser.

[1] Refuse derived fuel is the residue left over from various forms of waste processing that is compressed into pellets to burn as a fuel substitute

2.5 Mechanical biological treatment uses a combination of mechanical and biological techniques to sort, separate, and stabilise mixed household waste. Most systems involve the initial separation of recyclable materials followed by anaerobic digestion, or similar, to stabilise the organic content. Other systems use mechanical systems to shred the waste into small pieces, which are then separated for recycling, processing or disposal. Another option includes the use of thermal treatment where waste is effectively cooked in a sealed container using saturated steam. This sterilises the waste and reduces its volume. It can then be separated for further processing. In many cases the dry residue is suitable for use as a 'refuse derived fuel' to be burned in other processes (e.g. in cement kilns).

2.6 Each of these processes vary in the size of facility needed, the range of wastes that can be treated and the type of residual waste that remains but each provides some form of energy recovery either as a solid fuel, possible soil conditioner or gas (see Panel 1). These methods are not yet widely used in the UK for waste management and none have been proposed in Nottinghamshire.

Panel 1: Other types of Energy Recovery

Gasification – waste is heated to temperatures above 1000^{o}C with only limited oxygen so that the waste does not combust fully and produces a gas (known as syngas) which can be used either as a fuel or chemical feedstock.

Pyrolysis – waste is heated at lower temperatures (400^{o}C – 800^{o}C) without oxygen. The gas produced is not as clean as that from gasification and the process is generally less energy efficient. Because of the lower temperatures involved more of the chemical energy remains in the solid residue. Both pyrolisis and gasifiifcation can potentially be used to treat a range of commercial, industrial and municipal waste as well as clinical and hazardous waste in some cases.

Anaerobic Digestion - biodegradable organic waste is broken down by bacteria in a heated, sealed and airless container. This can take between 15 and 30 days depending on the temperature used. The biogas produced can be used for heat and electricity generation, the leachate provides a potential liquid fertiliser and the solid fibre residue can be used as a soil conditioner. The process has potential uses to treat sewage sludge, agricultural, municipal and industrial wastes.

Mechanical Biological Treatment - is not a single technology but a combination of processes to mechanically separate the waste and then stabilise it through a biological process such as composting or anaerobic digestion. The output will include varying amounts of solid residue (refuse derived fuel), compost and gas depending on the combination of technologies used. MBT is currently used to treat municipal waste in some parts of the UK.

Site Requirements

2.7 Although plants will vary in size and according to the exact process they use, most will have similar requirements in terms of access and buildings to house plant and equipment. In general they will need some or all of the following:

- Vehicle access
- Building(s)
- Reception/storage area
- Screening plant
- Shredder
- Digestion tanks
- Sealed drainage system
- Boiler
- Heat Exchanger(s)
- Emissions stack
- Emissions control equipment
- Ash storage
- Connection to national grid/ neighbouring power users

Environmental Impacts

2.8 The potential impacts of energy recovery will again vary according to its size, design, and location. A site within an existing industrial area is likely to be less noticeable than an isolated site in the open countryside for example. The main impacts considered here are those caused by the operation itself e.g. visual impact, traffic and emissions. There are other important potential concerns such as the impact on wildlife, habitats and heritage but these are issues that relate to the choice of site rather than the impact of a particular type of facility. These issues will therefore be covered under specific development control policies and are also addressed as part of the ongoing sustainability appraisal of each of the plan documents.

2.9 Panel 2 is therefore intended to illustrate the possible impacts that energy recovery facilities may have on those living or working nearby. It summarises the typical issues that need to be considered but this does not mean that they will apply in every case.

2.10 The key issue is whether these impacts are acceptable i.e. is there a risk of harm or disturbance? In many cases, environmental impacts can be minimised through careful site design, layout and operation but there may be times where the potential impacts of a development mean that it should not be permitted at a particular location.

Panel 2: Environmental Impacts

Traffic – most facilities are likely to be served by large volumes of HGVs although small-scale anaerobic digestion plants may have less of an impact. Careful site location and routeing agreements can be used to minimise the traffic impacts and there may be benefits in locating facilitates alongside other waste management operations to reduce the overall number of vehicle movements. The use of rail or water based transport should also be considered if possible.

Visual Impact – the main impacts are likely to come from the buildings, tanks, containers, fixed or mobile plant and storage areas. Where energy is exported to the national grid or other users, cables and supports may also have a visual impact. Site design, colour treatment of buildings and screening/landscaping measures can help to minimise visual intrusion. It may also be possible to partially bury some of the development to lower its impact.

Noise – vehicle movements, the unloading of waste, and ventilation/filtration systems are potential sources of noise. Avoiding proximity to residential areas or other noise sensitive properties, fitting vehicle/plant silencers and smart reversing alarms, acoustic screening, maximum noise limits and controlling working hours can help keep noise within acceptable limits.

Odour – where operations are enclosed within a building or a sealed vessel, there should be little odour risk. Basic precautions over the storage and handling of waste should further minimise any potential odour problems. Mechanical biological treatment has greater potential for odour due to the mixed nature of the waste and the need to transfer waste between different processes but the same precautions should minimise any risk. If odour is likely then negative pressure air systems can be used to contain and treat the air within a building.

Dust – waste handling and vehicle movements can give rise to dust. The use of water sprays, wheel wash facilities and hard-surfacing for internal site roads can prevent dust problems off-site.

Air – gasification and pyrolysis creates similar emissions to incineration (i.e. acid gases, carbon dioxide, heavy metals, dioxins/furans and particulates). Emissions are strictly regulated by the Environment Agency and flue gas treatment is used to filter any emissions to air. Mechanical biological treatment and anaerobic digestion should have lower emissions than other processes but there is potential for bio-aerosols to be produced. Enclosed processing, air filtration and siting facilities up to 250 metres from other development should minimise any risk.

Water – waste-water is most likely to arise from anaerobic digestion although all sites will need sealed drainage to prevent possible contamination. Where leachate is a by-product of the process there may be a need for a collection tank and/or treatment facilities.

What types of site are suitable?

2.11 Although the processing operations may vary, the size and scale of development will be determined by the amount of waste to be treated. Pyrolysis and gasification plants can have a capacity ranging from around 50,000 to 250,000 tonnes a year. This may be smaller for very specific wastes such as hazardous or clinical waste. Anaerobic digestion plants are typically smaller – treating up to around 50,000 tonnes a year. The size of mechanical biological treatment facilities will very according to types of process used.

2.12 In most cases, the site area and scale of any buildings will be compatible with small to medium size industrial units. Pyrolysis and gasification in particular are likely to have an industrial appearance due to the emissions stack. Anaerobic digestion can potentially be housed in a low rise building and may be suitable alongside other agricultural development in rural areas or as part of a sewage treatment works depending on the type of waste being treated. Mechanical biological treatment may require a larger building or possibly several smaller buildings.

2.13 As with most types of waste plant, energy recovery facilities should be close to the source of waste and will require good vehicle access. Other forms of transport such as rail and water are will only be viable at very large sites or where there is a single source of waste. These requirements favour industrial areas or possibly business parks, particularly where nearby buildings/industries can make use of the energy generated that could utilise the energy generated.

2.14 Energy recovery facilities are unlikely to be appropriate in mainly rural areas or open countryside unless there is an overriding local need and the impacts of traffic, noise etc. are very low key.

3. Current provision and future needs

What is the current situation?

3.1 They are very few operational facilities in the UK although there have been a number of trials. There is an operational pyrolysis plant near Bristol, and Leicestershire now has an anaerobic digestion facility for municipal waste. Nottinghamshire does not have any of these facilities although it does have the region's only municipal waste incinerator at Eastcroft in Nottingham (see Background Paper 5).

How much do we need in future?

3.2 Although these technologies are less-proven than incineration, they do offer a possible alternative to meet at least some of our future waste management needs. The following paragraphs therefore examine the main categories of waste that could potentially be treated.

a) Municipal Waste

3.3 The Government has set strict limits on the landfill of municipal waste and there are likely to be limits for other waste types in future. In order to meet these national targets, the Regional Waste Strategy for the East Midlands, published in January 2006, sets out estimates of future waste arisings and how much waste should be managed by recycling, landfill or other means (See Table 1 below).

Table 1: Landfill diversion estimates for Nottinghamshire (tonnes per annum)

Year	Recycle/ Compost	Landfill Diversion	Landfill Allowance	Total Waste
2005	***155,000***	***150,000***	***313,000***	***630,000***
2010	**213,000**	**128,000**	**369,000**	**710,000**
2015	**386,000**	**162,000**	**224,000**	**772,000**
2020	**386,000**	**214,000**	**172,000**	**772,000**

Source: Regional Waste Strategy for the East Midlands. EMRA, January 2006

3.4 Even if all the recycling targets are met there will still be a significant volume of waste that needs to be 'diverted' from landfill in some way. This could be either through incineration (see Background Paper 5) or any combination of the technologies discussed here. Approximately 150,000 tonnes of municipal waste is already incinerated each year at Eastcroft and this will continue under existing contracts. This leaves approximately 65,000 tonnes of additional waste that will need to be diverted by 2020.

3.5 This is the minimum needed to ensure that landfill targets are met but local authorities can opt to divert more of their municipal waste from landfill. The only restriction is that this should not be at the expense of recycling. On this basis, Nottinghamshire could divert almost 400,000 tonnes a year if it chose to incinerate all the municipal waste that would otherwise go to landfill. This is more sustainable in terms of the waste hierarchy and would mean that only residual waste that cannot be recycled or recovered would have to go to landfill. Following this maximum recovery option would require up to 240,000 tonnes additional energy recovery capacity each year by 2020.

b) Commercial and Industrial Waste

3.6 As well as municipal waste, there is also up to a million tonnes of commercial and industrial waste sent to landfill in Nottinghamshire each year (see Background Paper 2). A large proportion of this could presumably be used for energy recovery although this should not be at the expense of efforts to recycle more waste. The various technologies considered here have only typically been used for municipal waste but there is no technical reason to suggest that they cannot be used for other mixed wastes. The relative cost of energy recovery and the lack of targets for commercial and industrial waste have hindered any large-scale investment so far but this may change in future as landfill costs rise. Anaerobic digestion on its own would only be able to treat the organic fraction of the waste stream but could have a useful role in conjunction with other facilities.

c) Other Wastes

3.7 Anaerobic digestion is already used on a small scale in the UK for treating farm wastes (e.g. animal slurry) and it has also been used successfully to treat sewage sludge. Recovering energy from these wastes is more of a by-product of stabilising the waste but highlights that there are potential benefits.

What are the options to meet future needs?

3.8 The role of the Core Strategy is to decide on the most appropriate option to meet the landfill diversion targets. Background Paper 5 considers the potential role of incineration in meeting future needs but it is also important to look at the contribution that could be made by other forms of energy recovery. A key issue will therefore be whether to opt to do minimum necessary to meet the municipal waste landfill targets or to make much wider use of energy recovery (including commercial and industrial waste) in order to reduce our overall landfill needs.

3.9 As a minimum, Nottinghamshire will need an additional 65,000 tonnes of incineration or other recovery capacity each year for municipal waste by 2020. Meeting only this minimum target for municipal waste mean that landfill rates would continue at their maximum permitted level and there would not be any opportunity to reduce landfill still further. This approach also runs the risk that if the challenging 50% recycling/composting target for municipal waste cannot be met, there would be no option but to exceed the maximum landfill rates (see Panel 3). Any authority breaching its maximum landfill allowance would have to purchase additional landfill permits or face heavy fines. However, keeping energy recovery levels low, may be a way of encouraging a higher than 50% rate for recycling and composting but it is not yet known whether this is achievable in practice.

3.10 An alternative approach would be to make much greater use of energy recovery. This could divert anything up to 386,000 tonnes of municipal waste a year from landfill – requiring up to a maximum 240,000 tonnes of additional energy recovery capacity. This would significantly reduce future municipal waste disposal but may be seen as potentially discouraging any future effort to recycle above 50% of municipal waste. A major increase in capacity could also make it more likely that waste is imported from outside Nottinghamshire – especially if adjacent authorities do not develop significant energy recovery capacity of their own.

3.11 At present the waste industry in Nottinghamshire has only put forward proposals to increase incineration capacity. A recent application to extend the Eastcroft municipal waste incinerator in Nottingham was refused by the City council on regeneration grounds but the applicants are appealing this decision. A new 180,000 tonne energy from waste incinerator is also proposed to serve north Nottinghamshire as part of the County Council's municipal waste management contract (see Panel 3). If approved, these two proposals would see incineration increase to over 400,000 tonnes per annum. This may preclude the development of other forms of energy recovery facilities for municipal waste but there may be considerable scope to manage other types of waste.

3.13 The likelihood of alternative types of energy recovery being promoted in Nottinghamshire is therefore very uncertain and difficult to quantity. It will depend very much on the approach taken with respect to incineration.

Panel 3: Local authority waste management contracts

As well as their planning functions, County Councils and Unitary Authorities, such as the City Council, are responsible for ensuring the safe management and disposal of municipal waste. This is done through a process of letting contracts to private sector operators who provide the actual waste management facilities such as landfill and recycling sites.

These contracts are based on 'municipal waste management strategies' which seek to provide an integrated and sustainable framework for future municipal waste management. The County Council prepared its municipal waste management strategy jointly with the Nottinghamshire districts in 2001. This identified a long-term need to provide at least an additional 100,000 tonnes of incineration capacity or 340,000 tonnes of mechanical biological treatment, or similar, in order to meet landfill reduction targets. The City Council is preparing a complimentary strategy of its own.

After extensive negotiation and appraisal, the County Council agreed its new contract in July 2006 with Veolia Environmental Services. This will provide a recycling/composting rate of over 50% and reduce the landfill of municipal waste to minimum levels. Proposals put forward by Veolia include a large-scale incinerator with energy recovery to serve the north Nottinghamshire area. If approved, this would divert around 180,000 tonnes of waste from landfill each year[2]. All proposals under the new contract will require planning permission. They will be tested against policies in the existing Waste Local Plan adopted in 2002 and any other material considerations such as the emerging policies within the new development pan documents and any new Government guidance.

The City Council is currently developing its waste management strategy to help inform the longer-term procurement of waste management contracts that will aim to maximise recycling and composting and minimise waste to landfill.

Local authority waste management contracts only apply to municipal waste - all other wastes are by managed by private, commercial agreements between individual companies and contractors.

[2] This does not include leftover ash to landfill (assumed to be approx. 20%)

4. Conclusions

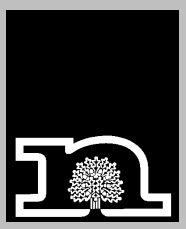
4.1 Whatever the future recycling rate, it is likely that there will be a need for at least some additional energy recovery in order to meet the landfill targets set by Government. This could be from any combination of newer technologies or from more conventional incineration (see Background Paper 5).

4.2 Some of the alternative forms of energy recovery are untested in the UK but this does not mean that proposals will not come forward. Future limits on the amount of waste that is allowed to landfill and the increasing cost of disposal are likely to promote greater commercial interest in interest in energy recovery of all types. Although incineration has been put forward as the preferred method for treating municipal waste, this does not rule out the use of alternative forms of energy recovery, either in combination with incineration, or to treat other types of waste.

4.3 A significant increase in energy recovery, combined with high levels of recycling and composting is likely to be the only realistic option for reducing our long-term reliance on landfill – whether for municipal, commercial or industrial waste. A key role of the Waste Core Strategy will therefore be to determine what is the most appropriate approach for Nottinghamshire.

Further Information

- ODPM research study 'Planning for Waste Management Facilities: A Research Study' August 2004



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