Planning Guidance Note on Energy from Waste Technologies

This guidance note is aimed at local authority planning officers to inform local planning decisions.

1.1 Introduction

Energy from waste (EfW) is an overarching term for a range of technologies that "use waste as an energy source" and therefore through the process "recover energy from waste". The energy may be converted into: heat; power (in terms of electricity); or both. If the technology converts the waste into both heat and electricity, this is known as combined heat and power (CHP).

EfW has been identified as having an important role to play in the overall treatment of waste materials. This role is set out in the European Waste Framework Directive which introduced the Waste Hierarchy (Figure 1). The waste hierarchy illustrates the guiding principles of waste management by identifying the preference of options available for the treatment of waste materials and is adopted in EU and UK legislation.

The hierarchy clearly identifies the preference for energy recovery from waste over disposal and therefore suggests this is more desirable than the final disposal of waste in a landfill, as is often the case in the UK.

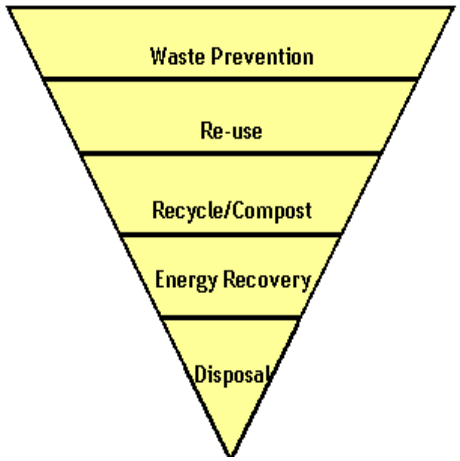

Figure 1: The Waste Hierarchy

With local authorities having statutory targets to divert waste from landfill, there is an increased interest in EfW technologies. This briefing note gives a description of the technologies and sets out the key planning implications for consideration by planning authorities.

1.2 The EfW technologies

There are a wide variety of EfW technologies with different modes of operation and different outputs. These technologies fall into two main categories:

- Thermal treatment (when heat is applied to the waste materials)
- Non -thermal treatment (when biological processes are used to generate energy).

Thermal treatment technologies

Direct combustion (incineration): This process is the burning of either: a segregated and tailored wood waste feedstock; a secondary recovered fuel (SRF) (the high calorific waste segregated into a fuel); or general waste arising from domestic or commercial sources. Through combustion of waste, heat is generated which can be converted into power (in the form of electricity), or exported from the facility as heat in the form of hot water or steam (combined heat and power, CHP). The outputs from this process are the incinerator bottom ash, any recovered metals and residues arising from the combustion gas cleaning process (air pollution control

residues or APC). Incinerators can vary in size from 60,000 tonnes per annum (tpa) up to 600,000 tpa, Incinerators are often large scaled when compared to other EfW technologies and can require significantly sized buildings, both in footprint and height, to house the operations.

Advanced thermal technologies (ATT): is when heat is applied to a prepared waste or secondary recovered fuel (SRF) (where waste has been processed to extract the high calorific fraction) within a limited oxygen supply. There are a range of technologies that fall under this term. ATT are largely unproven for mixed wastes on a commercial scale in the UK, and overseas experience is limited. Historically, they have usually been small scale facilities (10,000 – 20,000 tpa); however they have increased in scale in recent years (20,000 – 100,000 tpa).

The two primary technologies commonly regarded as advanced thermal treatment are:

- Pyrolysis: is a medium temperature (300 – 850ºC) thermal process where organic derived material in the waste is broken down when heated in the absence of oxygen. The process breaks down plastics, paper and other organic derived materials to produce a gas (known as syngas), which can then be combusted, to produce power and heat.
- Gasification: operates at a higher temperature range than pyrolysis, typically above 650ºC and with limited oxygen, but like pyrolysis produces a syngas for other application including energy generation.

Non-thermal-treatment technologies

Anaerobic Digestion (AD): is the main non-thermal treatment technology. (See Envirolink Guidance Note on AD). AD is a biological process where biodegradable wastes, such as food waste or a mechanically separated organic rich fraction, are converted into a 'digestate' and biogas. The wastes are decomposed by microbes in the absence of oxygen (anaerobic process). This differs to composting, which is an aerobic process, taking place in the presence of oxygen. AD systems are enclosed, engineered vertical or horizontal vessels where the biodegradable material degrades and generates biogas. The biogas produced, comprises methane and carbon dioxide, which is collected and can be used on or off site. Biogas can be used in a number of ways but is usually combusted in a gas engine to produce electricity and heat. It is the use of the biogas from the AD process to generate electricity and heat that classifies AD as an EfW technology. The residue from AD (digestate and liquor) can be applied to land as fertiliser subject to obtaining regulatory approval.

Mechanical biological treatment (MBT): is a residual waste treatment process, and is a generic term for the integration of several processes, primarily of a mechanical and biological nature. MBT facilities can incorporate a number of different waste processes such as aerobic or anaerobic digestion of waste, in a variety of different combinations and can be built for a range of different purposes. Inclusion of AD technologies or treatment of SRF may mean that MBT facilities would be included in an EfW plant.

This wide variety of EfW technologies means that EfW can be considered an overarching term used to describe a number of different technologies and processes. Planning requirements and specifications will vary for each technology and site, however below; the general planning considerations have been outlined.

2 The Planning Process

An unprecedented number of new waste facilities to treat Municipal Solid Waste (MSW) will require planning permissions in order that the UK as a whole can meet the various statutory and non-statutory targets. Therefore in recent years there has been an increase in the level of experience Local Planning and Waste Planning Authorities have in planning and permitting waste treatment facilities (see regulatory section). There is good experience of the conventional and established waste management facilities, such as incineration, but only patchy practical experience associated with new and emerging technologies. For example, gasification and pyrolysis have different site and general planning control issues compared with methods such as incineration, with many involving the application of process techniques more characteristic of industrial processing. These are usually housed within modern industrial type buildings and are more typical of developments which have general industrial B2 Use Class characteristics. With these new technologies there are the associated number of more complex issues identified which are resulting in delays and practical difficulties in delivering these facilities.

2.1 Environmental Impact Assessment

The requirement for an Environmental Impact Assessment is set out in Schedules 1 and 2 of the Town and Country Planning (Environmental Impact Assessment, England and Wales) Regulations 1999. These schedules set out what developments will require an EIA and what thresholds apply. Under Schedule 1 an EIA will be required for waste facilities dealing with hazardous waste or any waste if the throughput exceeds 100 tonnes per day. If the proposed facility does not meet these criteria then the thresholds set out in Schedule 2 will apply. An EIA will be required for installations for the disposal of waste if:

1) The disposal is by incineration
2) The area of the development exceeds 0.5 hectares
3) The installation is to be sited within 100 metres of any controlled waters.

Local planning authorities will have a role in the screening (deciding whether an EIA is required) and scoping (deciding what the key environmental issues will be) stages of the project. The requirements for information to be included in each document is set out in the EIA regulations but for screening and scoping it should include the following basic information:

a) A plan sufficient to identify the land
b) A brief description of the nature and purpose of the development and of its possible effects on the environment
c) Such other information or representations as the person making the request may wish to provide or make. The LPA must respond within a defined time period – three weeks for screening and five weeks for scoping.

The time required to complete an EIA will vary with the scale and nature of the proposed development and the site location. Surveys can be time consuming with some ecological surveys requiring in excess of six weeks to complete. It should also be noted that here are seasonal constraints most notably in relation to ecological surveys but can also be applied to traffic surveys as well.

A further requirement of the EIA process is the consideration of alternatives not only in terms of site selection but also potentially the technologies proposed. The EIA will therefore need to be supported by a robust case for the proposed site and development and an indication why the alternatives have been rejected.

2.2 The consideration of alternatives in site selection

Consideration of alternative sites and technologies is now recognised as an important part of any proposal seeking planning permission for any waste facilities. Where the proposals are defined as an environmental impact assessment (EIA) project under the terms of the EIA Regulations, consideration of alternatives is an obligatory requirement as defined under Schedule 4 'Information to be included in an Environmental Statement'. This states under Section 2:

"An outline of the main alternatives studied by the applicant or appellant and an indication of the main reasons for his choice, taking into account the environmental effect."

At present there is no clear guidance on the form or content of an alternatives assessment. This is likely to vary according to the local context. For example where there is clear policy guidance in an up-to-date Development Plan which indicates preferred sites for waste management facilities; it is likely that the scope of any alternatives assessment can be limited. Similarly if the relevant waste strategy indicates certain preferences in terms of technology or facility types then any assessment of alternative management options in the planning application would be expected to draw upon this.

Where no such context is available to guide the choice of the preferred option, the applicant may be expected to demonstrate that they have undertaken a methodical appraisal of all the relevant alternatives (sites and technologies). In terms of alternative sites this can involve a constraints-based assessment. As with other waste developments, the potential negative perceptions of waste sites mean that any EfW application will need to demonstrate not only why a particular site is being put forward, but also why a particular choice of technology is proposed. This is especially so for Incineration facilities, whereby the requirement for significant building sizes, concerns over traffic, noise and air quality issues will all require a robust description of why a facility, of the capacity and treatment technology is being proposed.

2.3 Demonstrating 'need'

Prior to the publication of PPS 10 an important consideration for developers and Waste Planning Authorities with regard to planning proposals for waste facilities was the issue of need. Unlike other forms of development where there is no such expectation, there was a requirement for waste developers to set out a case of 'need' to support their proposals. In PPS 10 this requirement has been removed where proposals conform to the development plan, as set out in paragraph 22 of the PPS:

"When proposals are consistent with an up-to-date development plan, waste planning authorities should not require applicants for new or enhanced waste management facilities to demonstrate a quantitative or market need for their proposal."

3 Planning Considerations

There are various planning documents (outlined in the further information section) that will impact the planning procedure, however there are a number of key considerations which are required to be addressed (which are common for all EfW facilities) when planning officers are reviewing planning applications.

Modern EfW facilities are often closer to industrial processes than they are to more traditional waste management facilities (such as landfill). Waste handling and processing operations are contained within buildings, allowing tighter environmental controls to be put in place. The operational equipment associated with EfW will include waste storage (typically internal), sometimes requiring below ground structures such as pits or bunkers.

The generation of energy will involve combustion at some point, and so emissions to air will need to be considered, as well as any visual implications of stacks or flues. The industrial nature of EfW facilities could potentially include materials handling equipment, conveyors, shredders, crane grabs, cooling equipment, turbines or gas engines and other potentially noise generating equipment.

EfW technologies typically involve a significant reduction in volume of materials (unlike other waste sites such as transfer stations or Materials Recycling Facilities (MRFs). As such, planning considerations need to include both the delivery of waste to the facility as well as the removal of any residues or outputs.

3.1 Design

PPS 10 when discussing the design of new waste facilities states:

"Good design and layout in new development can help to secure opportunities for sustainable waste management, including for kerbside collection and community recycling as well as for larger waste facilities. Planning authorities should ensure that new development makes sufficient provision for waste management and promote designs and layouts that secure the integration of waste management facilities without adverse impact on the street scene or, in less developed areas, the local landscape."

The design of a new EfW facility is therefore important to consider in its planning application in order to aid its progression through the planning application process. More information on the importance of this design can be found in the Defra document; Designing Waste Facilities: a guide to modern design in waste. It also includes examples of good design and information on how to mitigate visual impact.

3.2 Footprint requirements and land take

EfW facilities have been developed in a range of sizes which can vary due to the nature of the internal processes involved. The size of a facility is very much dependant on the operations that will take place, and is likely to be the overriding factor in determining size. For example an incineration facility is likely to be significantly larger than an AD facility due to the space requirement associated with boilers and combustion grate. The need to expose combustion gasses to a temperature of 850^{o}C for at least two seconds in order to destroy organic compounds within this part of an incineration plant will require a significant roof height, resulting in tall buildings.

The capacity of the plant will also affect the overall size, as will any requirements for ancillary activities (for example on-site bottom ash processing for incineration or digestate maturation for AD facilities). The amount of waste storage to be provided at a site will also impact on the overall facility size with many facilities requiring several days waste storage capacity.

Due to the range of space requirements arising from the different EfW technologies, it is not possible to derive a 'one size fits all' approach when looking at footprint and land take, however Defra have produced a table showing some typical operational facilities and their associated land take.

ATT facility (or incinerator)	Size, (tpa)	Buildings area, m^2	Total land take, ha
Energy from Waste/Incineration*	90,000	5,850	1.7
Energy from Waste/Incineration*	250,000	6,600	4
Pyrolysis†	60,000		0.98
Pyrolysis†	12,500	200	+ access
Pyrolysis†	35,000	28,000 - 32,000	4
'General ATT'*	50,000	3,600	1-2

Source: * = Planning for Waste Management Facilities - A Research Study † = Defra Waste Technology Data Centre.

AD facilities on the other hand, tend be designed with the emphasis on vertical processing chambers therefore reducing the site's footprint. However, where the solid digestate is to be aerobically composted in windrows for its maturation phase, this will increase the facility's footprint due to the large land requirements needed for this process stage.

Smaller EfW facilities utilising waste as an input fuel source, are modular and therefore could have a range of land take sizes, from those which are able to be built in a basement of a block of flats to a large facility with a suitably sized land take.

3.3 Proximity principle

The transport network and distance a feedstock travels before it is processed by a facility is determined by the facility's proximity to the waste arising. Therefore, whilst it may be seen as preferable to locate a large EfW facility away from potential receptors such as residential housing, it will inevitably mean that it will be located away from the largest source of waste arisings and therefore the waste material would have to travel a greater distance before it enters a facility. Therefore an ideal location for any EfW facility would be within close proximity to the waste arisings.

3.4 Transportation and access

Typically traffic issues and site access have been points of contention for local residents close to a proposed EfW location. An EfW facility will usually require a delivery of waste feedstock, and removal of output materials, through the local highway infrastructure, unless there is a

specific onsite waste source (e.g. biomass incinerator located on timber merchants). Planning applications should include a traffic impact assessment indicating the routes of transporting waste, the size and number of vehicles delivering waste to the facility. Planners need to assess the potential impact of these waste movements (e.g. the requirement for improvement work to enable the local highways to accommodate any increase in traffic and to ensure road junctions and other infrastructure does not exceed capacity.) Planners will also need to assess methods to reduce the impact of traffic movements, such as:

- Preference for more sustainable methods of waste deliveries to a facility (such as by river and rail)
- Back hauling facility outputs in delivery vehicles to reduce vehicle movements;
- The use of transfer stations to bulk up waste being delivered to an EfW facility to reduce overall number of traffic movements through the use of larger vehicles.

It should also be noted that the traffic data will be required to feed into any air quality and noise assessments as road traffic impacts have the potential to be significant.

3.5 Air emissions and potential health effects – waste incineration directive (WID)

The air emissions of EfW facilities do vary by their technology use. ATT air emissions from flue gases tend to be lower than those produced through more conventional incineration processes. This is because it is gas of a more homogenous nature that is being combusted, rather than waste of a varying composition typically treated by incineration facilities. As such incineration facilities typically include more significant stack structures and flue gas clean up measures than other EfW technologies. Planning applications will need to demonstrate that potential EfW facilities will be able to operate within the relevant environmental limits, which may require the submission of detailed air quality modelling results to demonstrate this.

All EfW facilities are regulated by the Waste Incineration Directive (WID), (see regulation section) which sets limits on the level of emissions permitted. These international standards are normally met and exceeded by modern EfW facilities and there have been a number of independent reviews of the health impacts of these emissions from EfW facilities which suggest there is little or no negative impact on health due to the exposure of these emissions. Emissions to air are also tightly controlled through the environmental permitting process administered and enforced by the Environment Agency, however the granting of an Environmental Permit is typically post planning, but the planning and permitting application process can run concurrently.

For EfW utilising wood waste or biomass as a feedstock, then it is advisable to contact the Environment Agency to confirm the classification of the waste material to understand how it is to be regulated under the WID[1].

3.6 Amenity issues (litter, dust, odour, flies, vermin, birds)

Any waste treatment facility presents an opportunity for the rise of dust and odours, however good housekeeping of a site can ensure that these are kept to a minimum. This may include carrying out all activities indoors and dust suppression measures being introduced for vehicles

[1] http://www.renewableseast.org.uk/uploads/RE-Guidance-Note-3.pdf

entering and leaving the site. Additionally, the enclosed nature of EfW technologies greatly limits the potential for birds and vermin to become an operating issue. In warm weather, flies brought in with the waste deliveries may accumulate, which will require appropriate housekeeping measures to reduce.

3.7 Noise

As with other industrial developments, planning applications for EfW facilities should demonstrate that noise levels emitted by the facility will be kept to acceptable levels. The enclosed nature of EfW operations with delivery, handling and processing of waste within a main building will aid this, however suitable noise predictions, employing specialised modelling software may be required to demonstrate this is achievable.

3.8 Waste resources (ground and surface water, flood risk)

The enclosed nature of EfW facilities provides greater control over environmental emissions including any waterborne emissions. The issues regarding the management of leachate from other waste facilities such as landfill sites are not applicable to EfW as waste is typically stored internally, within impermeable storage areas. Process water, surface runoff from operational areas and other sources of 'potentially contaminated' water will require capture and management, as it would for other industrial facilities such as food manufacture, and planning applications should demonstrate this will be achievable. Sustainable building design measures such as the use of rainwater harvesting for use in the process can be encouraged and viewed positively during planning.

For AD facilities there should be a number of measures included in the facility's design such as impermeable surfaces, which are required through the Animal By-Products Regulations. (See regulation section.)

As with other developments, the impact that a development could have upon flooding needs consideration and a flood risk assessment provided, if applicable.

3.9 Landscape and visual considerations

As shown with the PPS 10 document the design of a facility should mitigate the visual impact it may have on the surrounding environment. Consideration regarding design should be made on the construction of new buildings in so much as it does not negatively impact the visual environment. The use of screening features which may be introduced as a mitigation measure where it is felt the design of the facility would be detrimental to the surrounding landscape. Other mitigation measures can include the use of architectural design to improve visual appearance, the use of colour for buildings and equipment and consideration of construction materials to reduce the visual impact of a facility.

Different EfW facilities would potentially have differing potential visual impacts. Incineration facilities represent the most significant building sizes and stack heights, whereas AD facilities will have a requirement for external digester tanks, of a smaller height, but potentially more industrial in nature.

3.10 Nature and conservation

As with any industrial development, EfW applications have the potential to impact upon ecology either through direct loss (if developing a sensitive site), or on adjacent sites. Direct impacts upon ecology potentially include loss of habitat, fragmentation of habitat or direct mortality to

individuals through construction of a facility, if the development site contains sensitive habitats or species. Appropriate ecology surveys should be carried out and submitted, where appropriate, along with suitable mitigation where direct impacts are identified.

Indirect impacts arising from EfW facilities can potentially arise due to traffic generation, noise, dust, litter and external lighting from the facility affecting ecologically sensitive areas adjacent to close to the facility. As with other developments, these will need to be considered by the planning process, and suitable mitigation provided, if applicable. Other indirect impacts such as, airborne emissions and pollution to water resources have the potential to affect sites further away from the EfW facility, and again will need to be assessed and mitigated, if appropriate. Designated sites within the area should be identified and assessed to make sure any potential impact is acceptable and the local authorities obligations under the Habitats Regulations (sometimes referred to as Appropriate Assessment), should be considered if there are potential impacts upon protected European Sites.

3.11 Socio-economic considerations

Planning applications for facilities should also consider the socio-economic impacts of locating a facility. These can include the number of potential jobs, created at the site through the construction and operational phases and the impact this will have on the local community. This is particularly relevant if the land identified currently holds some employment value.

In addition to this, EfW could have local benefits with regards to the heat and energy take off; if the facility is located close to a mix of receptors such as a business park or residential areas, these receptors could benefit from being linked in to a decentralised energy network utilising the facilities electrical or heat production directly.

3.12 Public consultation and engagement

Generally there tends to be negative public perceptions of EfW facilities, especially incinerators. This has largely been based on the older generation of facilities which were operational in the 1970s. However ATT and AD facilities are modern technologies and so there is little or no historical legacy influencing the public's perceptions of these facilities.

Due to the contentious nature of waste development, planning applications are likely to be the subject of a close level of scrutiny from objectors, consultees and other stakeholders. Timescales to achieve planning consent are often much longer due to sites failing to obtain permission, or becoming the subject of judicial review or public inquiry. This is particularly so for large scale incineration facilities. As with all waste treatment facilities, early public consultation prior to the planning application stage may reduce the likelihood of public opposition to a planning application. Therefore planners should encourage applicants at the pre-application stages to engage with the local community.

4 Regulatory Requirements

4.1.1 Environmental permitting

Permitting or environmental permitting relates to the regulation and control of the waste technology processes during its operation. This is essential as it ensures regulatory compliance of the facility's activities and it is also the system used by the Environment Agency to control certain activities that have local environmental or human health impacts. Planning permission

will need to be granted, and the facility will need to obtain an environmental permit from the relevant regulatory body (either the Environment Agency or the local authority depending on the size of the facility), before operations can commence.

4.1.2 Waste incineration directive (WID)

The aim of the WID is to prevent or limit, any, negative effects on the environment, in particular pollution by emissions into air, soil, surface and groundwater, and the resulting risks to human health, from the incineration of waste. The WID sets stringent operational conditions, technical requirements and emission limits to ensure that the environment and human's health are protected to a high standard. The Environment Agency regulates these operations through the environmental permit that would be required to operate an EfW facility. The Environment Agency will regularly monitor and inspect sites to ensure that compliance is followed.

4.2 Animal by-products directive

Animal by-products must be treated and disposed of in accordance with specified stringent standards. The Directive sets strict animal and public health rules for the collection, transport, storage, handling, processing and use or disposal of all animal by-products (ABPs).

The regulations classify animal by-products into three categories based on their potential risk to animals, the public or the environment, these include:

Category 1 - Very high risk material including animals that have been experimented on

Category 2 - High risk material including diseased animals

Category 3 - Low risk material, which is fit, but not intended, for human consumption including raw meat and fish from food manufacturers and retailers, former foodstuffs other than catering waste

All premises where animal by-products are received, treated or disposed have to be officially approved or authorised. Each category must be disposed of appropriately, Categories 1 and 2 must be disposed of by direct incineration or rendering followed by incineration or landfill of the remaining animal tissue. Category 3 materials must be disposed of by incineration, rendering followed by incineration or landfill, anaerobic digestion, alkaline hydrolysis plant or in vessel composting or biogas plant.

5 Further Information

Defra Guidance in designing waste facilities – http://www.defra.gov.uk/environment/waste/localauth/documents/designing-waste-facilities-guide.pdf

The Planning Portal - http://www.planningportal.gov.uk/

PPS10 – http://www.communities.gov.uk/planningandbuilding/planning/planningpolicyguidance/mineralsandwaste/wastemanagement/pps10/

Review of environmental and health effects of waste management: municipal solid waste and similar wastes (May 2004) - http://www.defra.gov.uk/ENVIRONMENT/waste/statistics/health.htm

Defra Guidance on waste technologies - http://www.defra.gov.uk/environment/waste/residual/newtech/supporter.htm

How to comply with your environmental permit. Additional guidance for: The Incineration of Waste (EPR 5.01) - http://publications.environment-agency.gov.uk/pdf/GEHO0209BPIO-e-e.pdf

Environmental Permitting Guidance. The Directive on the Incineration of Waste - http://www.defra.gov.uk/environment/policy/permits/documents/wid-guidance.pdf