Waste Incineration:
An Evaluation of Government Targets for Energy from Waste (EfW)

by

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Thesis presented in part-fulfilment of the degree of Master of Science in accordance with the regulations of the University of East Anglia

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Abstract

This study examines the development of Energy from Waste incineration within the waste strategies of local authorities in England. With the development of *Waste Strategy 2000 for England*, produced by DEFRA, (then DETR) and the inclusion of statutory recovery targets for the recovery of energy from waste, along with the implementation of the Landfill Directive (99/31/EC), there created a need for introduction of EfW incineration as an alternative waste disposal option.

The study looks at how local authorities are implementing EfW within their waste management plans, and to see whether it is being developed as part of an integrated waste management system.

The study, based on quantitative and qualitative research methods of waste management plans, and of personal communication suggests that the development of EfW incineration is being hindered through the widespread public opposition that exists, as a result of the perception of health risks that the incineration process poses.

Further more, the reluctance of local authorities to develop an integrated waste management system containing EfW incineration comprises the long-term feasibility, and sustainability of waste management within England.
**Acknowledgments**

I would like to thank first and foremost Dr Dick Cobb for his invaluable academic supervision and enthusiasm throughout this dissertation, as well as for the support and confidence he gave me from every meeting and point of contact that occurred from start to finish.

I would also like to thank the other MSc course staff, Mat, Elaine, Jon and Stuart for their advice and guidance throughout the year.

Thanks must also go to the people who agreed to undertake interviews, without which the study would have seriously have been compromised. Likewise the members at the Chartered Institute of Waste Management library in Northampton, who allowed me to use the library, and provided valuable assistance in my research.

Finally, thanks must go to all my friends and family for their continual support and enthusiasm towards this study, for having confidence in my ability throughout the duration of the Masters course.
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<td>AONB</td>
<td>Areas of Outstanding Natural Beauty</td>
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<td>BPEO</td>
<td>Best Practicable Environmental Option</td>
</tr>
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<td>CIWM</td>
<td>Chartered Institute of Waste Management</td>
</tr>
<tr>
<td>DEFRA</td>
<td>Department of Environment, Farming and Rural Affairs</td>
</tr>
<tr>
<td>DETR</td>
<td>Department of Environment, Transport and the Regions</td>
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<tr>
<td>DTI</td>
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<td>EC</td>
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<td>EfW</td>
<td>Energy from Waste</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>EU</td>
<td>European Union</td>
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<td>HA</td>
<td>Health Authority</td>
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<tr>
<td>IEMA</td>
<td>Institute of Environmental Management and Assessment</td>
</tr>
<tr>
<td>IPCC</td>
<td>Integrated Pollution Control Commission</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standard Organisation</td>
</tr>
<tr>
<td>IWMS</td>
<td>Integrated Waste Management System</td>
</tr>
<tr>
<td>LA 21</td>
<td>Local Agenda 21</td>
</tr>
<tr>
<td>MRF</td>
<td>Materials Recycling Function</td>
</tr>
<tr>
<td>NIMBY</td>
<td>Not In My Back Yard</td>
</tr>
<tr>
<td>NSCA</td>
<td>National Society for Clean Air and Environmental Protection</td>
</tr>
<tr>
<td>SEA</td>
<td>Strategic Environmental Assessment</td>
</tr>
<tr>
<td>SEPA</td>
<td>Scottish Environmental Protection Agency</td>
</tr>
<tr>
<td>SSSI</td>
<td>Sites of Special Scientific Interest</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>WMP</td>
<td>Waste Management Plan</td>
</tr>
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1 Introduction to Waste Management

1.1 Summary

Waste is a by-product of human activity. It is defined commonly as anything which “lacks value” or has “useless remains” (White et al. 1995). It is this lack of value which has led to millions of tonnes of unwanted items, commonly referred to as waste being thrown away ever since the birth of man on the planet. However, the increase in population has consequently caused the increase in the amounts of waste that are produced, and so therefore has made the management of waste very difficult.

Waste management has long been one of the principal concerns for politicians, planners, and the public alike, with an ever increasing population producing ever increasing quantities of waste that has no where to go. There has always been a concern for where waste goes. However it has often been determined by the most economically viable option, and with little concern for the earth’s natural resources or the environment.

1.2 Introduction to Study

This study looks at the role that Energy from Waste (EfW) incineration is playing within local authorities waste management plans (WMPs) in the UK, and how it is helping local authorities achieve the government recovery targets. The study also aims to examine the reasons why local authorities may not be implementing EfW as an alternative to landfill, and also how they are developing Integrated Waste Management Systems (IWMS), through the implementation of EfW.

1.3 History of Waste Management

Waste in the UK first became a major issue during the industrial revolution, which led to large increase in rural to urban migration, which in turn caused a substantial increase in the populations of many urban settlements, and therefore consequently led
to a massive increase in the volume of waste that was being created (Williams 1998). Waste management was born, its arrival was due mainly to the fact that living conditions had become unacceptable due to the amount of rubbish that had begun to cover the streets in which people lived and worked (Foxall 2003). The streets soon became a hazard for human health, as dangerous materials such as broken glass, metal fragments and human waste attracted flies and vermin, allowing disease to develop, and to be transmitted (Williams 1998).

Waste management has been born out of social necessity, as the link between public health and the environment was identified. This link became the basis for early waste management efforts, as legislation was introduced, in order to try and improve the way that waste was being dealt with (Foxall 2003, Williams 1998). The most significant early legislation to be passed in the UK was the 1875 Public Health Act, which created a duty on local councils to arrange for the removal and disposal of waste (Foxall 2003). Early disposal methods normally consisted of burning waste, whether this was by people in their own homes, or in mass scale incinerators, or destructors as they were know during this period (Foxall 2003). In fact the use of incinerators became increasingly important, and from the first destructor built in Nottingham in 1874, the next forty years harboured the development of around a further three hundred incinerators, designed to dispose of municipal waste on a large scale (Williams 1998). The design of the destructors was such that all waste was burnt, but they were also capable of generating electricity from the steam that was generated1. In fact, seventy-six of the incinerators that were built had some form of power generation, and acted as precursor to the modern day Energy from Waste (EfW) incinerators (Foxall 2003).

Although the use of incinerators was relatively popular and successful, they soon became too expensive to run and maintain, and so the use of them became discouraged, and limited, in favour of the more simple and cost effective method that is landfill (Waite 1995). Still widely in use today, landfill came about mainly due to the ease of disposal that it offered, as well as offering a ‘out of sight, out of mind’ option, along with creating a centralised waste management option in towns and cities.

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for the local authorities that were responsible for the management of waste (Williams 1998). Despite the ease of disposal that landfill offered, they also posed major environmental and health implications, as many were poorly designed, poorly maintained and often attracted large amounts of vermin (Waite 1995).

Landfill however poses another problem: without an effective recycling and composting strategy, many valuable resources in the waste stream become lost forever, without any benefit being gained from them. Future local authority strategies must look at how to divert recyclables from entering landfill (Waite 1995).

1.4 Sustainability in waste management

In recent years however the issue of sustainability has been introduced through the Brundtland Report paper ‘Our Common Future’, which defines the notion of sustainability as ‘development that that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (WCED 1987). Sustainability thus requires that natural resources be efficiently managed and conserved, if possible (White et al. 1995).

The Brundtland Report and the Rio Summit in 1992 became the drivers that have been necessary to change the approach to environmental management. It is facilitated and implemented at the local level through Local Agenda 21 (LA21), a sustainability ‘blue print’ that is expected to be produced by all local authorities, on matters of the environment, community, and the local economy, and is expected to form the basis of future decisions and plans, as a programme to encourage sustainability (Voisey & Church 1999). Barr (2002) believes that a connecting link between the economic and ecological goals of sustainability is critical if LA21 is to be successful. Therefore, determining a method of waste management that is cost beneficial and also environmentally advantageous is of high importance in achieving a sustainable future for all, as the treatment and disposal of waste is now recognised as one of the central themes of sustainable development (Foxall 2003).
1.5 Waste Strategy 2000

Waste Strategy 2000 is the national waste strategy for England and Wales, however in 2002 a parallel strategy was produced for Wales, and so from 2002 the Waste Strategy applies solely to England (DETR 2001). Likewise, Waste Strategies for Scotland were developed in partnership between the Department of the Environment, Transport and the Regions (DETR) and the Scottish Environmental Protection Agency (SEPA) and also for Northern Ireland by the DETR. The driver for the development of the Waste Strategies has been the EC Waste Framework Directive (75/442/EEC) as amended by EC Directive 91/156/EEC. This European Directive requires all member states to develop and implement a national waste strategy, which includes details on the recovery and disposal of waste (Williams 1998). Originally in England, the national waste strategy entitled “Making Waste Work” was transposed through the 1995 Environment Act; however it has since been updated by the more comprehensive “Waste Strategy 2000” (England and Wales) (DETR 2001).

The Waste Strategy 2000 was developed by the UK government as a result of a need for change within UK waste management, and the aim was to put waste to good use and deliver change within this sector. As a result of the need to deliver change, a number of national targets were set. The targets are in response to the EU Landfill Directive (99/31/EC), which sets mandatory targets for the reduction of biodegradable waste, sent to landfill (DETR 2001, p.11). In response to the Landfill Directive, the UK Government has set intermediate recycling/composting and recovery targets for household waste, which are outlined in table 1, below;

<table>
<thead>
<tr>
<th>By Year</th>
<th>Recovery of Municipal Waste</th>
<th>Recycling &amp; Composting of Household Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>40%</td>
<td>25%</td>
</tr>
<tr>
<td>2010</td>
<td>45%</td>
<td>30%</td>
</tr>
<tr>
<td>2015</td>
<td>67%</td>
<td>33%</td>
</tr>
</tbody>
</table>

Table 2: EU Landfill Directive Targets

<table>
<thead>
<tr>
<th>By Year</th>
<th>Reduce biodegradable municipal waste to level, of that landfilled in 1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>25%</td>
</tr>
<tr>
<td>2015</td>
<td>50%</td>
</tr>
<tr>
<td>2020</td>
<td>65%</td>
</tr>
</tbody>
</table>


The Waste Strategy 2000 targets have been developed in order to reduce the reliance upon landfill, along with the EU Landfill Directive targets in table 2, and must be implemented with its basis upon the waste hierarchy.

The waste hierarchy was developed in order to provide a theoretical framework, based dually upon sustainability aims and also incorporating the Best Practicable Environmental Option (BPEO), on which future waste management should be based.

**Figure 1: The Waste Management Hierarchy**

1.6 The Waste Hierarchy

The waste hierarchy is a concept which was developed by the UK Government, in response to the requirement to develop a National Waste Strategy, that is sustainable, under EC Directive 91/156/EEC. The hierarchy aims to prioritise the way in which waste is treated and disposed of within the UK, with waste reduction the priority, and disposal, such as landfill being the least preferred option. Indeed, reduction or reuse of waste may not be achievable in most cases, and so the recovery of waste through recycling, composting and EfW incineration becomes critically important waste management practices. Indeed the ‘best’ disposal option will inevitably depend upon the environmental and economic circumstances of each scenario. Therefore, it is argued, the principle of Best Practicable Environmental Option (BPEO) should be applied, preferably within an integrated waste management system (Williams 1998).

1.7 Recovery Options

Recovery is defined, by the DETR in its document, “Guidance on Municipal Waste Management Strategies” as “the means to obtain value from waste through recycling, composting, other forms of material recovery, or recovery of energy” (2001, p.11).

The recovery targets as set by the government are ambitious, because in 2000, only 9% of waste was recycled and a further 8% was recovered (DETR 2000). Therefore the remaining 83% of the 106 million tonnes of waste produced by households each year was sent to landfill. However, as table 3 shows, the breakdown of household (municipal), industrial and commercial wastes produced in the UK are quite different, with the household sector proving the least successful in terms of recovery, of the three. One explanation for this may be the fact that in the other sectors, due to financial constraints, there may be more encouragement to reuse and recycle material, a basic concept that restores a “value” to waste, and therefore the material ceases to be a “waste” anymore, and thus will help reduce the business’ raw material costs (White et al. 1995). Likewise, the introduction of landfill tax, introduced within the UK in 1996, gives value to waste, and attempts to create a situation where the landfill of waste, becomes an economically un-viable disposal route (Waite 1995). Another
explanation may be that due to the improved environmental culture that exists within business today. The introduction of environmental standards such as ISO14001 has encouraged some companies and supply chains to improve their waste management performance.

Table 3: Disposal methods of Industrial, Commercial & Household Wastes in 1998/99

<table>
<thead>
<tr>
<th></th>
<th>Landfill</th>
<th>Recovery (Including recycling &amp; composting)</th>
<th>Recycling/Composting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Waste</td>
<td>47%</td>
<td>45%</td>
<td>39%</td>
</tr>
<tr>
<td>(Excluding construction &amp; demolition waste)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial Waste</td>
<td>66%</td>
<td>33%</td>
<td>29%</td>
</tr>
<tr>
<td>Municipal Waste</td>
<td>83%</td>
<td>17%</td>
<td>9%</td>
</tr>
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Although the figures in Table 3 date back to 1998/1999, there is still along way to go in order to achieve the statutory targets of 25% recycling and 40% recovery by 2005. Many local authorities are putting their efforts into improving recycling rates, but are neglecting other methods such as composting, which would help complement recycling and help improve the recovery rate, in order to reach the 40% target. However, perhaps the method that would achieve greatest energy recovery, and no doubt help the majority of local authorities achieve their recovery targets, is one of the most controversial in terms of public perception: energy from waste incineration.

1.8 Energy from Waste

Energy from Waste (EfW) incineration can create a solution to many waste management problems, by helping to reduce the mass of waste by 70% and, also reducing the volume of waste by around 90%, with the energy recovered also helping to reduce costs (Williams 1995). If implemented effectively, EfW will not conflict with recycling or composting efforts, and also help to meet the statutory government recovery targets. Evidence from other countries such as Japan, Sweden, the
Netherlands and the USA, indicates that high recycling rates can co-exist with high EfW rates, where they are part of an integrated waste management system (Petts 1995 p.9). Indeed Williams (1998, 5) believes that “in many cases the type of waste dictates that incineration is not only the most economic option, but also the best practicable environmental option”, despite the UK Governments appointed Select Committee on ‘Delivering Sustainable Waste Management’ expressing concerns that “incineration ‘crowds out’ recycling” (House of Commons 2000/01). However there is still a relatively large public body that remains in opposition to incineration, due to the perception that it has gained over a number of years (NSCA 2001).
Figure 2: Municipal Waste Incinerators in England and Wales, 2003.


2 The Role of Energy from Waste

2.1 Background

Energy from Waste can encompass a number of varying techniques. However in common practice it is a shorthand term used for deriving energy from waste incineration (House of Commons 2001).

Within the UK currently, Energy from Waste (EfW) plays a very limited role, as outlined by the fact that there are currently only twelve EfW incinerators in operation within England, disposing of only around 8% of municipal waste (House of Commons 2001, Environment Agency 2003). (See figure 2). There is however a lack of understanding over the role that it can play within waste management system, and also of the potential health risk that it may or may not pose. However, the Waste Strategy 2000 notes that energy recovery will need to play a part in local and regional solutions developed over the next few years, which may include EfW incineration (DETR 2001).

2.2 Legislation

A vitally important change in terms of legislative control occurred on 28th December 2002, when the Waste Incineration Regulations were implemented. These regulations transpose the Waste Incineration Directive 2000/76/EC into UK practice, through guidelines issued to the Environment Agency and local authorities, and aim to provide assistance as to the technical aspects of the Directive, and how they should be interpreted and applied by EfW operators (DEFRA 2002).

Indeed, the Waste Incineration Directive 2000/76/EC, is in itself a further tightening of legislation governing incineration within the UK, as it both incorporates and further extends the 1989 Municipal Waste Incineration Directives, 89/429/EEC and 89/369/EEC, and also combines within the Directive the Hazardous Waste Incineration Directive, 94/67/EC, in order to form a single, and fully comprehensive
set of legislation for the management of incineration within the UK (DEFRA 2002). According to Simmons (2000), given the legislation that there is governing waste incineration, is probably the most highly regulated for any waste management process in the UK. Further more, there is additional legislation that must be complied with for new EfW facilities, such as Integrated Pollution Prevention Control (IPPC) Authorisation in order to operate, as well as the new plants having to meet emission limits set out in the Waste Incineration Directive, which has highly stringent limits on the release of dioxins, as well “stringent emission limit values for waste incineration plants”. ³

The planning process is also comprehensive and highly regulated, and requires an Environmental Impact Assessment (EIA) to be undertaken for any proposed EfW development, which will consider a range of predominantly environmental factors, but should also seek to consider social and economic implications (Glasson et al 1999). The EIA should also attain compliance with the EIA regulations in order to meet certain standards (Simmons 2000). This, therefore in theory could require a thorough and detailed EIA to be undertaken, that considers significant impacts, and reviews a number of alternative sites (Wathern 1988).

### 2.3 Health Impacts

Currently, the Health Authority (HA) are consulted by the Environment Agency prior to the development of a new incinerator, with the HA giving advice over the potential health effects that may result from the incinerator, yet this relatively impartial view is taken along with the public’s, when a final decision is made by the Environment Agency (Environment Agency 2002).

However, according to a study undertaken by the National Society for Clean Air and Environmental Protection (NSCA), the potential for health impacts arising from EfW is now so low as to be negligible (IEMA 2002). Indeed Porteous (1998, p201) concurs with such evidence, stating, “Dioxins emitted from modern incinerators pose

no real health hazards”. However, it is still one of the main factors behind public opposition of EfW incineration, based on the threat of dioxin emissions posing potential health effects, and being seen by some, such as Greenpeace as “cancer factories” (Brown 2002). In fact, there is a whole host of academic evidence, which is based upon a number of health studies to suggest that dioxins do not pose a health risk from EfW incineration, if they comply with the emission regulations (NSCA 2001, Porteous 1998, Waite 1995, Simmons 2000). In fact according to Simmons (2000), dioxins have been shown to occur throughout the environment, from sources such as steel making, vehicle exhausts, and coal and oil-fired power stations. The current EfW incinerator facilities are responsible for only four percent of the UK annual dioxin emissions, which suggests that the health risk that they pose is minimal, and is being grossly amplified by the inaccurate public perception, as is discussed in the following section, on the public perception of incineration (Simmons 2000).

Indeed, evidence of falling dioxin emission rates has been reported by the Department of Health, stating that since 1990, and the introduction of the initial Waste Incineration Directive, (89/429/EEC), dioxin levels emitted from EfW incinerators have fallen by 99%, where as emissions of lead have dropped by 97% (Energy from Waste Association 2000).

Further evidence in the form of data from Swedish EfW incineration plants in 1999, suggests that plants there break down 90-95% of the dioxins in the waste (Swedish Association of Waste Management 2002). Likewise, Porteous (2001, pp. 160-161) reports “EfW incineration dioxin emissions to air are now very small”, as a reduction of around 98% is achieved from 100,000 tonnes of waste, which commonly contains around 0.7g of dioxins before treatment.

2.4 Public Perception and Concern

Although the discussion around EfW inevitably involves around the emissions of dioxins, as has been discussed, wholesale improvements in the legislation governing incineration have been made (Simmons 2000, NSCA 2001). However, this is a situation requiring effective risk management, as the consideration of risk within the
context of societal values, has already implicitly been undertaken, and so requiring risk management that aims to inform, and build trust (Holgate 2001). Such a process is a difficult one, with risk management relying upon the building of trust between the two opposing sides. However, any approach must communicate in a coherent and transparent way, but also understand underlying concerns, particularly of the most sensitive stakeholder groups in every case (Holgate 2001).

Previously in the 1960’s and 1970’s, dioxins, the common emission concern today, were largely not understood, and so their release was largely uncontrolled (Simmons 2000). Since then much stricter air emission legislation has been introduced. The 1989 European Directive on Emission Standards forced the closure of many old and polluting incinerators within the UK; with many unable to afford the costs required in order to upgrade technology in order to comply with the new Directive (Simmons 2000, NSCA 2001). Indeed the fact that these incinerators were allowed to operate for such a lengthy period of time, up to thirty years for some, was indeed unacceptable, and has created a public perception of incineration that will be hard to change (House of Commons 2000/01).

It is argued now, that public perception has progressed from the mass opposition against the incinerators of the 1960s and 1970s and perception nowadays is based upon a wider range considerations and risks (Petts 1995). Indeed, Snary (2001, p268) argues that public perception is indeed not irrational, but is now largely concerned over such issues as the appropriateness of the waste management option, the trust worthiness of the waste industry and the perceived fairness of the decision making process, a situation that can only be improved by improved risk communication throughout the waste management facility planning process.

However, according to Löfstedt (1996, p.689), risk communication can be used as an effective tool for the development of communication programmes which help inform concerned populations of the risks to the environment, their health and the potential technological hazards that they may be exposed to. However, it is important that risk perception is looked at and understood, before appropriate risk communication is undertaken.
In an area where there still remains a lack of education, and where two-way information exchange, especially during the planning process is non-existent, especially where media bias is not prevalent, it is doubtful whether public perception really has progressed to this advanced educated state (Snary 2000). A view that is more likely is one that public perceptions centre on health risks, and are “underpinned by the reaction of specific communities against existing and proposed facilities in their local area”, a view which suggests the majority of public perception is from ‘word of mouth’, and questions whether the majority of perception has a grounding in fact.

Furthermore when a comparison of health risks resulting from EfW incinerators is made, with various other every day activities it is estimated that the risk of a chronically exposed person developing cancer from a modern day EfW incinerator, is 7 in 10 million (over a 70 year lifetime). So, when we consider the UK population of 60 million, this roughly equates to 1 cancer every 2 years, compared to the 15000 people who die each year from the diet related bowel cancer (Porteous, 1998).

In many cases, the siting of a new incinerator is normally heavily influenced by public opinion, and so no matter what changes have been implemented within and surrounding the EfW industry, it is imperative that the public are involved. Indeed as Renn (1998, p.49) notes that there are claims that “risk is a social construction rather than a representation of real hazards”, therefore creating a need for more democratic procedures, and the inclusion of the general public in helping define what levels of risk are in fact tolerable. Indeed the House of Commons Select Committee (2001) reports that the public must indeed be convinced that the “regulation and inspection regime is adequate and sufficiently thorough”; in order for them to believe that incineration is safe. However, it is the responsibility of the EfW operators to adhere strictly to the regulations, so as to backup a “new trust” that may be displayed by the public towards EfW incineration. However, there still remains a conflict over the role that public perception should play within the risk management of a development, and whether public perception of risk should be the guiding principle for the management of risks (Renn 1998).
There needs to be an independent body set up that will monitor all air emissions, on a regular basis, and at all existing and new facilities within the UK, in order to provide a basis on which trust can be built between operators and the public (Rae 1995). Indeed the regulation and monitoring must encompass all emissions, the handling of ash and all other aspects of the operation (House of Commons 2001). Recently, two applications within the local authority of Surrey were turned down at the last possible moment, after fears were aired by the Capel Action Group, on grounds that monitoring was being conducted by operators, and enforcement notices were being ignored at the Edmonton incinerator after emission levels were being exceeded (House of Commons 2001).

However, the potential for improvement and involvement of the public is high, which could lead to positive public perception, giving benefit to both the general public and for the future of waste management. Indeed Petts (1995 p.23) agrees that there is a need for more informed discussion and open debate between stakeholders, in order to achieve a degree of consensus.

2.5 Environmental Impacts

Under the Waste Strategy 2000 BPEO (Best Practicable Environmental Option) has become a key criteria which must be considered in the development of any new waste management strategy or facility, as outlined within section 1.6. Analysis of the BPEO is essential in determining what really may be the best waste management option, in differing situations and circumstances. However it is likely that EfW incineration proves to be the BPEO for various non-recyclable and non-compostable materials in the majority of locations (IEMA 2002). BPEO is an appropriate appraisal method in which to use in such circumstances, as it involves the analysis of alternatives to determine the option that provides the most benefit or least damage to the environment as a whole, at an acceptable cost (Petts, 1995). However, BPEO offers most benefit when used within a more strategic planning system, when it is considered at the earliest possible time, such as within a hierarchy;
With the implementation of BPEO in this way, it provides a longer-term approach to waste management, and the development for the correct waste facility and strategy for each waste stream, at each location for the long term. It provides a Strategic Environmental Assessment (SEA) type approach that can only beneficial towards the way that waste is managed within the UK, and also towards the development of further EfW incinerators. An approach like this has already been undertaken in the Netherlands, with a Ten-Year Programme, from 1992-2002 developed by the Dutch Waste Management Council, which has provided a programme framework, which plans and coordinates technology, and looks at the capacity for waste processing over a ten-year period. SEA was used in order to develop this framework programme, which looked at many alternatives, and has also, near to its completion been reviewed by the Dutch EIA Commission (Verheem 1996). In order to minimize the environmental impact of waste management, a number of key environmental indicators were chosen, against which alternatives would be compared.
The environmental indicators developed in the Dutch National Environmental Policy Programme were:

- Dispersion of toxic materials in the environment;
- Acidification;
- Disturbance (e.g. noise, odour);
- Climatic change;
- Use of energy;
- Production of residuals; and
- Use of space.


The summary of the waste management programme proposed, concluded that the best-case scenario as provisionally planned for would be for the initial separation of waste into compostable and recyclable wastes, and for the remaining wastes to be incinerated by EfW incineration. Landfilling of this remaining waste would be forbidden. This option was seen as a “good compromise between feasibility, reasonable impact on the environment and compatibility with existing environmental policy objectives” (Verheem, 1996, p92).

Accordingly, Brown (2002) comments on the fact that recovering energy from various waste streams through EfW incineration, is likely to be the BPEO in many locations, and although it is noted that there will still be some environmental impact, as opposed to zero environmental impact, which is largely impossible, it will prove the least environmental damaging method for the long term management of waste. This contrasts with the relatively impossible target, as proposed by Friends of the Earth, that the ultimate aim must be to recycle 100% of waste, with zero disposal to landfill or incineration (2000, p.5). Although this is something that should be strived for, however realistically, zero disposal to landfill or incineration is not a feasible option within the current waste management climate.
2.6 The Need for Integrated Waste Management

The need for the long-term management of waste is an obvious one in terms of the impact upon the environment, and consequences for human health. However, as discussed previously, over the long term, a variety of waste disposal options are likely to be required, in order to deal with various waste streams, geographical locations, public preference and cost allowances, in as sustainable way as is possible. Indeed, the introduction of a lifecycle assessment of waste management systems has recently been introduced in order to help determine the environmental sustainability of a waste management system. This approach, complemented with an economic lifecycle assessment, can determine these two key components of an effective waste management system (White et al 1995).

Integrated waste management has been defined by Warmer Bulletin (1996, 49) as “the integration of waste streams, collection and treatment methods, environmental benefit, economic optimisation and societal acceptability into a practical system for any region”. Indeed a range of treatment and disposal options should be employed, with the waste hierarchy in mind, and each with an equally important role to play. It is the overall waste management system that is important, and should be the most environmentally and economically appropriate for a particular area (Williams, 1999).

It is necessary for the system to be holistic in its approach, as all of the components are interconnected, and highly cohesive approach will help manage the system in the most appropriate way (White et al. 1995). Figure 5 shows an integrated waste management system that follows the waste hierarchy in terms of the priorities in which waste is dealt with. (See figure 1).

If local authorities are to produce and implement effective integrated waste management systems, then clear guidance is required, in order to prevent a fragmented approach, as is currently being experienced by a number of local authorities, who are implementing a range of new waste management techniques, such as recycling and composting. Fragmentation of approach may lead to individual technologies or approaches duplicating one another, or doubling the impact of
potential, unforeseen inefficiencies, and overall is likely to lead to a system that is environmentally and economically ineffective (White et al. 1995).

A holistic approach by local authorities will ensure several advantages;

- An overall picture of waste management, which essentially will allow for strategic planning to occur.
- Environmental benefit will occur as a result of the system’s environmental burden being looked at as whole, with interconnectedness likely to reduce environmental harm.
- Economic benefit, is likely to occur due to the whole systems being looked at, and the financial viability of the whole system being determined, as opposed to looking at the viability of the parts, which may ultimately lead to an overall economic loss.

As is seen from figure 4, EfW can have a clear and highly important role to play within an integrated waste management system. Within this system, it is clearly seen that the introduction of EfW incineration does not hinder the efforts of recycling or composting, which without doubt could remain as the primary aims for recovery. Indeed, the Department of Trade and Industry (DTI), promote an integrated approach to waste management, and “take account of opportunities for Combined Heat and Power (CHP) and community heating, which EfW can provide” (1995, p.45).

Once as much material as possible is taken out of the waste stream through recycling and composting, then EfW can still produce benefits in the form of local heat and power, rather than through the traditional method of burying all waste within landfill. Admittedly, some waste will still need to be landfilled, but this could be a minor percentage of what is currently being put into landfill, comprising the residual outputs from the EfW process, plus any non combustible household and commercial waste (Williams, 1998). There may come a stage when recycling reaches such a high level that most combustibles are extracted from the waste stream, and there will be little available waste to burn by EfW incineration. When that point comes it may spell the
end for EfW, but this situation will not occur for many years, and concentration at this moment in time should be put into readdressing the waste that is disposed of in landfill (Energy from Waste Foundation 2002).

What must be highlighted in reference to the integrated waste management system, is the role that the Waste Strategies of local authorities have to play in developing such integrated systems. However, within the guidance for developing waste strategies, there is no specific pressure towards developing an integrated waste management system. There is a statement promoting the need of developing integrated policies and proposals for collection, treatment and disposal options, yet it is unknown how seriously local authorities will be in implementing such directions (DETR 2001). It is seemingly up to each local authority to develop their own system, which without guidance is unlikely to be an integrated waste management system, and is likely to lead to a fragmented, and less efficient approach.

Integrated waste management has already been developed within the UK though, with the implementation the Project Integra integrated waste management plan by Hampshire County Council (Williams 1998). The plan is actually operated by a private company, and not the local authority. However it involves a wide range of waste disposal options, which include; waste minimisation, recycling, composting, anaerobic digestion, EfW incineration, and landfill with energy recovery from landfill gas. Indeed EfW incineration plays an important role within this integrated system, with three EfW incinerators located throughout the county, with around 48% of waste generated within the local authority being disposed of by such means (Williams 1998).

The key issue is the recovery targets which must be achieved, and the efforts that must be made by local authorities in order to meet such targets, whether it is within an integrated waste management system or not. This study will aim to identify and review the progress that is being made by local authorities in meeting the recovery targets, through the implementation of EfW incineration, and aim to identify the position within the UK and make recommendations as to the future role that EfW should play within waste management in the UK.
2.7 Research Aims

Following on from the review of literature and justification, this study researched the following aims and issues;

- To evaluate the role that EfW incineration is playing within local authorities waste management strategies, and whether it is helping to achieve government recovery targets.

- To investigate the factors that are preventing the development of EfW incineration within local authorities.

- How local authorities are looking to achieve recovery targets without EfW incineration.

- To review the progress of local authorities in developing EfW incineration as part of an Integrated Waste Management System.
3 Methodology

3.1 Background

The aim was to develop a systematic review technique of Waste Management Plans (WMPs), that specifically highlighted, and investigated whether EfW incineration had become a common element within local authority waste management plans. The technique was developed so that any recommendation towards EfW would be put within the overall waste management context, in relation to recycling efforts and other energy recovery techniques that were included. The reliance of local authorities upon landfill would also be highlighted, in order to gain an idea of reasons behind the implementation of, or the exclusion of, Energy from Waste incineration, within the waste management plan.

Research surrounding the public perception of Energy from Waste incineration had already been undertaken by various bodies, such as the National Society for Clean Air and Environmental Protection (NSCA) who undertook “Public Acceptability of Incineration” in 2001. However much of this research has been undertaken from a viewpoint of public acceptability of such facilities. Other research has looked at environmental and health impacts, the role of EfW within waste management, and also the development of EfW as part of an integrated waste management system. Even Best Practice guidelines have been developed, which highlight potential concerns of implementing EfW, as well as discussing the benefits, and the need for “an integrated approach” (Department of Trade and Industry, 1995). However, this research aims to look at the actual progress that has been made by local authorities in the implementation of EfW, and to highlight the actual reasons behind the absence of EfW within waste management throughout local authorities. Further more, it will aim to look at the progress made, where EfW has been implemented, in developing an integrated waste management system. Hopefully the research outcomes will fulfil these insightful, and “practical” aims.
3.2 The Research Process

The aim of the research was to gain both a quantitative and qualitative insight into the information that was available. Therefore a review technique and interviews that are identified in sections 3.3 and 3.4 were highlighted as the most appropriate types of research for this particular study.

The aims of the study (section 2.7), required there to be a holistic approach to the research, which aimed to look at the readily available information through the review of Waste Management Plans, which consisted mainly of, yet not exclusively of, quantitative information. However the quantitative information available was in some cases rather limited, and would also have been portrayed in a way that promoted the image, and development of the local authorities waste management strategy.

Therefore, it was necessary to undertake further research that aimed to look at the ‘real’ issues behind the implementation or absence of EfW within the waste management plan, through a series of qualitative telephone interviews. The aim of the interviews was to gain information that was not readily available within the waste management plans, and gain an insight into the thinking behind the development of the WMPs.

The following sections, 3.3 and 3.4 help explain the development and design of both measures, and

3.3 Review Technique

It was felt that the most appropriate review technique to be used in this instance, where a large number of WMPs were reviewed, was that of a matrix. A matrix allows for a number of factors to be compared against one another, and will allow for the clear presentation and ease of assessment, when required in order to make conclusions and assess the overall progress being made, along with singling out individual local authorities who are performing well in implementing EfW within their waste strategy, and ones who dismiss the idea. The matrix is a commonly used tool in the
identification of impacts within the EIA process, and so it was felt to be suitable and competent method to use (Glasson et al 1999). Figure 5, is a list of the criteria that was developed in order to review the waste management plans. Results of this review are displayed in appendix a, which displays a tabulated version of figure 5.

Figure 5: Review criteria for Local Authority Waste Management Plans

<table>
<thead>
<tr>
<th>1. Recycling:</th>
<th>2. Energy Recovery:</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Current recycling %</td>
<td>▪ Current %</td>
</tr>
<tr>
<td>▪ Recycling % aim</td>
<td>▪ Recovery % aim</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Currently Incineration:</th>
<th>4. Incineration Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Y or N</td>
<td>□ Clinical</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. EfW in Waste Management Plan:</th>
<th>6. Any Plans for EfW:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>▪ Not cost beneficial</td>
</tr>
<tr>
<td></td>
<td>▪ Concern of public perception</td>
</tr>
<tr>
<td></td>
<td>▪ Unable to gain planning consent</td>
</tr>
<tr>
<td></td>
<td>▪ Plans within future strategy</td>
</tr>
<tr>
<td></td>
<td>▪ Other</td>
</tr>
</tbody>
</table>
7. Will EfW become part of an integrated waste management system:
- Y or N

3.3.1 Justification of Factors

The factors chosen were felt to be the factors which could be relatively easily researched within the WMPs, as well as being key indicators in the progress that was being made towards the development of EfW. Questions one and two on recycling rates and recovery rates, were included as both are key national targets, and according to the DETR’s Waste Strategy Guidance, both are statutory performance standards, and so their achievement, and therefore their reporting within the WMP was considered of key importance to research (DETR 2001). Therefore, the need to establish current levels of both recycling, and recovery, was a key priority in helping to gauge the level of progress that was currently being achieved by local authorities within England. It was felt that obtaining the current recycling rate was of use, in helping to provide an explanation for the recovery rate, or if EfW was not being implemented.

The following set of criteria, questions three and four, on whether there was currently incineration occurring within the local authority, in terms of clinical or hazardous waste incinerators that may be located within a particular local authority. Justification for the implementation of this criteria, was to see whether the existence of an existing facility prompted the local authority into developing an EfW facility, or whether it caused the public to become tolerant of incineration, and have a less anti-EfW perception. Justification for research into public perception stems from variety of sources, such as the NSCA report on the “Public Acceptability of Incineration” (2001), Porteous (1998) article on the public acceptability of Energy from Waste Incineration, and the perceived risks surrounding incineration (Petts 1995, Oppenheimer 2000, House of Commons 2000/01).

Question five and six were aimed at identifying how many local authorities had included an EfW proposal within their WMP and to look at the reasons behind the non-inclusion or possible implementation of EfW. This section was to be researched in greater depth through the interviews.

Finally, question seven attempted to gauge the level of progress there had been in proposing or developing EfW as part of an integrated waste management system, with the development of
such a system providing sustainable approach towards waste management, potentially providing local authorities with long term economic and environmental benefits (White et al 1995, Williams 1998).

3.3.2 Research Sample

Local authorities that are responsible for producing a waste management plan are County Councils, Unitary Authorities, Metropolitan Boroughs and London Boroughs. Exempt authorities are Borough and District Councils, which fall under the remit of County Councils. Within the review, the local authorities will be represented by the following coding:

County Councils (C),
Unitary Authorities (U),
Metropolitan Boroughs (M); and
London Boroughs (B)

To undertake a review of all 149 local authorities within England who are required to produce waste management plans, would prove largely unsuccessful due to issues over the non-availability of WMPs. The potential cost and time that it would take to access all of these plans was not deemed feasible, and so it was decided to generate and review a sample of local authorities. This sample design was based upon a number of factors:

1. **Local Authority Type;** A sample from all types of local authority was crucial in giving a good overview.
2. **Rural or Urban;** A mix of both rural and urban local authorities.
3. **Geography;** A mix of authorities from each of the major regions of England.
4. **Political allegiance;** Ideally a mix of political backgrounds would be ideal, however this was a secondary consideration.
5. **Availability;** The prime source of access to WMPs was from the Chartered Institute of Waste Management (CIWM) Library in Northampton. Various other WMPs could be accessed on the World Wide Web, however access often proved to be difficult.

With these criteria in mind, it was decided upon a sample that would be reflected in factors 1-4, with availability, factor 5, proving to be the main constriction factor. Figure 6 identifies the sample selection;
For the selected sample, the review technique was systematically worked through, in order to obtain as much detail as was possible from each waste management plan. Research was done on three separate dates within June 2003, at the CIWM library. In addition to this research, further information was obtained from the World Wide Web on a number of additional occasions, ranging through May and June, 2003. The review criteria were supplemented by notes from each WMP, in order to provide additional information that did not fall within the remit of the review criteria. Such additional detail enabled more accurate conclusions to be developed within the analysis of the results.
Figure 6: Selected Local Authority Sample
3.4 Interviews

As a follow up research method, it was decided that interviews should be undertaken, in order to investigate the ‘real’ reasons behind the implementation of EfW and the reasons behind the decisions not to develop EfW within the waste management strategy. The interview has an advantage over the more standard, and ‘rigid’ review technique, in that it can be adapted. Bell (1999) believes that interviews can help follow up ideas, probe responses and investigate motives and feelings. Indeed, the main aim of employing interviews as part of the research was to gain these more insightful responses.

It is noted however that interviews do pose the question of bias, due to the change in mood and various tones of voice that the interview uses, and how the various responses may affect the pattern of questions, from one respondent to another, which in turn may well affect future answers (Bell 1999, Sellitz et al. 1962).

In order to decide which local authorities were to be interviewed, the authorities were divided into three groupings: Firstly those who had already implemented EfW incineration, secondly, those who were planning implementing EfW, and lastly, those who were largely opposed to the idea of implementing EfW. It was decided to interview three or four local authorities from each grouping. This would provide roughly a 10% sample of those waste management plans that had been reviewed.

However, in order to do face-to-face interviews with all of the local authorities, would require a considerable amount of travelling time and cost, which was not feasible within the time scale and budget, and so telephone interviews were chosen. A semi structured plan was developed in order to ask specific questions, and to help guide the interview. The three interview structures used can be seen within the appendix, as numbers 1, 2, and 3. The interviews were conducted over a three-day period, in June 2003, and all within the afternoon, so as to reduce bias as much as possible. Interviews were commonly of around ten to fifteen minutes in duration, and largely followed the same pattern. Few problems were encountered, as most respondents were keen to speak, and give invaluable information, with many also regarding the research into EfW as an important and valuable research area.
4 Results and Discussion: Prospects for Energy from Waste

4.1 Introduction

The results obtained are a combination of qualitative and quantitative research, conducted at different time periods. However, to gain the greatest insights from the results, it is felt to be most appropriate if they are discussed in an integrated way.

4.2 The Development of an Integrated Waste Management System

The development of IWMS was wider spread than initially thought, with 50% of the local authorities’ WMPs reviewed introducing the idea of integrated waste management, and making the proposal for its implementation within the future. See figure 7.

Figure 7: Results of Integrated Waste Management System Development within Waste Management Plans

<table>
<thead>
<tr>
<th>Definite proposal for development of an IWMS</th>
<th>Possibility of developing an IWMS</th>
<th>No mention of developing a IWMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birmingham</td>
<td>Essex</td>
<td>Cheshire &amp; Halton</td>
</tr>
<tr>
<td>Bradford</td>
<td>Wakefield</td>
<td>Cumbria</td>
</tr>
<tr>
<td>Buckinghamshire</td>
<td>Telford &amp; Wrekin</td>
<td>Leicestershire</td>
</tr>
<tr>
<td>Cambridgeshire &amp; Peterborough</td>
<td></td>
<td>London Boroughs</td>
</tr>
<tr>
<td>Cornwall</td>
<td></td>
<td>Manchester</td>
</tr>
<tr>
<td>Durham</td>
<td></td>
<td>Northumberland</td>
</tr>
<tr>
<td>Gloucestershire</td>
<td></td>
<td>Rutland</td>
</tr>
<tr>
<td>Hampshire</td>
<td></td>
<td>Surrey</td>
</tr>
<tr>
<td>Lancashire</td>
<td></td>
<td>Warwickshire</td>
</tr>
<tr>
<td>Norfolk</td>
<td></td>
<td>West Sussex</td>
</tr>
<tr>
<td>Northamptonshire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Tyneside</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
It must be noted that for all the local authorities proposing an IWMS, all included EfW within this system, except Norfolk and Northamptonshire, who were proposing IWMS without EfW, which poses questions of the long-term validity, and viability of such proposals.

One of the most ‘progressive’ authorities at proposing an IWMS was Hampshire. Their proposal had already been implemented, despite the current availability of EfW incineration due to the ongoing facility re-development. Known as Project Integra, as introduced within section 2.6, this IWMS proposed a holistic approach towards the long-term management of waste. Other local authorities who were interviewed, such as Birmingham, Nottinghamshire and Lancashire local authorities highlighted the importance of implementing an IWMS, and the proposed “mixed approach to waste”, stated by Birmingham City Council (Latimer 2003), is seemingly the type of approach that is fortunately becoming more widespread within current waste management.

From an interview with Hampshire County Council, it was determined that the idea of Project Integra was born out of the lack of landfill that was available to the county, with estimates of around five years capacity left being the accepted figure. As a result, an alternative disposal solution was urgently required, and so the decision to implement EfW incineration within Hampshire was taken. The decision, according to the interviewee, was taken as EfW provided the most benefit from all of the alternatives, due to the recovery of energy, which could be, used elsewhere. Indeed the choice was made to develop three EfW facilities, at separate locations in Basingstoke, Portsmouth and Southampton. These EfW facilities will be able to cope with the extra demand that they will receive, once all landfill within the county has been used up, and so are providing a long-term solution to waste disposal. According to the council, initial barriers in the form of NIMBY (Not In My Back Yard) opposition was aired, however this referred more to the location of such developments, rather than the fact that EfW was being chosen as the disposal route.

The aim of Project Integra however, is not one that solely relies upon the implementation of EfW incineration, but has also seen the development of countywide composting facilities, as well as a concerted effort towards increasing recycling. Indeed, when asked, “will the development of EfW affect your current recycling programme in any way?”, the officer at Hampshire County Council confirmed that the aim of Project Integra is for an Integrated Waste Management
System”. This firm stance, together with the introduction of the development of IWMS by many local authorities, demonstrates that EfW can play a key role within such systems.

Cornwall County Council is another example of a local authority trying to develop an IWMS. However they were much earlier on in the process, and were using BPEO to determine whether EfW should play a role within their IWMS. Early reports from the council were that, EfW did indeed have an important role to play, albeit a smaller one than is currently being employed within the Hampshire scheme. However, Cornwall seem to expect problems in finding a suitable, or a number of suitable locations for the siting of an EfW facility. The expected siting problems are seen as a result of predicted widespread public opposition for such a facility or facilities. Finding land that is not protected by legislation such as SSSI’s (Sites of Special Scientific Interest) and AONB (Areas of Outstanding Natural Beauty) was also of concern to the county. Land prices were also likely to prove to be barrier to EfW development in Cornwall. However, it seemed from the response, that any decision was likely to wait until the pressure on availability of landfill became more of an issue (Cornwall County Council 2003).

Energy from Waste is indeed forming part of those proposed IWMS that are being implemented now, such as for Birmingham City Council. However, those authorities who are only now proposing the idea of an IWMS, and are a way off from implementing such a system are less decisive on the potential role that EfW may play. Local authorities seem unconvinced by the advantages of EfW, and are seemingly waiting around for further technological improvements, such as pyrolysis, gasification, or fluidised bed treatment.

Essex County Council’s strategy is a prime example of this, as thermal treatments, municipal burn technology, and mechanical biological treatment are options which are considered, in addition to recycling and composting, and also in addition to a relatively large proportion for landfill (ERM 2002). However, this reluctance to progress forward and implement a proven technology, (i.e. EfW incineration) is both causing unnecessary environmental impacts from the continual use of landfill, is also not gaining the energy recovery benefit that EfW incineration can provide, and is also acting as a smoke screen that is allowing local authorities to continue to use landfill for an extended period of time (Energy from Waste Foundation 2002).

Indeed, some landfill will need to remain of EfW facilities are introduced, so as to dispose of the bottom ash that is created from the EfW process, as well as remaining as a disposal route,
throughout the transition phase. However, hopefully the reliance upon landfill for the disposal of bottom ash should lessen, as alternative uses for it have developed, such as for it being used as an ingredient for road surfaces, or as a building material (Toussaint 1989). However not all bottom ash will able to be used this way so small amounts of landfill, specifically for disposal of this waste must still remain available (White et al 1995).

However, local authorities are seemingly reluctant to reduce the use of landfill, for as long as its capacity remains, as it is likely to remain as the cheapest disposal until landfill tax begins to have a serious economic impact, despite the fact that it tends to be the least environmental beneficial option. Guidance must be given to local authorities in order to encourage and prompt them to develop IWMS, so that a move away from landfill occurs sooner rather than later.

4.3 The Role of EfW within Waste Management Plans

Despite the current reluctance of local authorities to implement EfW incineration, there is a concerted effort for implementing EfW in the future, in the majority of the sample of WMPs. Only three local authorities, Cumbria County Council, Northamptonshire County Council and Northumbria County Council failed to introduce the idea of EfW as a method of waste disposal. However, Northamptonshire County Council highlighted EfW as a possible future method of waste disposal that may be necessary, in the WMP.

From the interview that was undertaken with Cumbria County Council, it was stated that “that there hadn’t been any consideration towards building a EfW incineration plant”. However since the publication of the WMP, a public consultation exercise had been undertaken, in order to find out what the general public’s preferred waste disposal routes were, which resulted in recycling and composting being the preferred choices. However, EfW did indeed figure within this consultation exercise, and so the implementation of such a facility could now be considered. Indeed it was noted that implementation of EfW would depend largely upon how it was “marketed” to the general public of Cumbria, as to whether they would accept such a scheme. In their current position, with the plentiful availability of landfill, there is seemingly no such necessity to make such a move (Faulkner 2003).
However, there is an increasingly urgent requirement that local authorities find alternatives to landfill, in terms of environmental impacts and legislation. In terms of economics, the Landfill Directive is causing a progressive shift away from landfill, however it is still the most widely used disposal method (Simmons 2000). Local authorities are happy to work towards the recovery targets, through a combination of recycling and composting, as both recycling and composting represent a necessity anyway, and offer a far cheaper option than implementing EfW. Battaglino (2001) argues that cost is not an option for local authorities. However responses from the interviews undertaken with local authorities as part of this research, indicates that cost is an important barrier to development of EfW, as opposed to the continued use of landfill.

When Essex County Council’s waste management plan, entitled “A Municipal Waste Strategy for Essex, Southend and Thurrock” is consulted, six alternative options for the long-term management of municipal waste are outlined. None of them specifically refer to the implementation of EfW incineration, yet some refer to the implementation of ‘thermal treatment’, which encompasses a range of mass burn technology. Other options consider mechanical-biological treatment, in addition to the recycling and composting schemes, which are present within all options. However, within all options, implementation of the alternative technologies, is not at an advanced stage, and seemingly will only be executed when landfill capacity runs out.

The recent government report, “Waste Not, Want Not” (Strategy Unit 2002) will hopefully, however have an impact upon improving the prominence of EfW within WMP. The report finds that there is clearly a need for an increase in EfW incineration, of up to 50% (Eduljee, 2003). The promptings of such reports as “Waste Not, Want Not”, should educate local authorities as to the alternatives of landfill, but are unlikely to realistically influence the role that EfW has within current waste management plans, due to the perception that it is economically unfeasible. It is therefore the place of the government, to back up their rhetoric and report findings, with either economic measures, or legislation to ensure that local authorities do make changes to their WMPs.

Indeed in Sweden, where EfW incineration plays an important role within both waste disposal and energy production, EfW plants are on a much smaller scale than within the UK, and are designed to dispose only of a districts waste, and then supply the same district with heat and hot
water from the EfW process. According to Söderman (2002, p.90), “district heating plants currently supply about 40% of the total use of space and water heating in the residential and service sectors in Sweden”. However, the role of EfW has since been increased as Sweden introduced a ban on the landfilling of combustible waste by 2002 and of organic waste by 2005 (Söderman, 2002). Indeed further policy instruments, such as landfill taxes for other waste streams have been implemented in order to make EfW incineration a viable technique within Swedish waste management.

Change such as that occurring in Sweden would be necessary within the UK, if EfW is to become a serious and viable alternative towards landfilling.

4.4 Recovery and Energy from Waste

Recovery as defined within the Waste Strategy 2000 is to obtain value from wastes through one or more of the following. The statutory recovery targets as set by the UK government are displayed within table 1, section 1.5.

- Recycling
- Composting
- Other forms of material recovery (i.e. anaerobic digestion)
- Energy recovery (EfW, Pyrolysis, gasification, other technologies)

Source: DETR (2000).

Figures on current recovery rates were extremely difficult to assess. Figure 10 provides the only recovery figures that were available in waste management plans from the sample. Further more, the interviews demonstrated that very little was known as to the progress that was being made towards achieving the recovery targets. Figure 10 shows that generally recovery figures are low. However, there are exceptions to the trend with Essex, Cambridgeshire and Peterborough and the Greater London Boroughs all achieving a recovery rate of over 25%, and within reach of the 40% target by 2005. The efforts of Essex and Cambridgeshire & Peterborough are impressive, due to the fact that these are achieved without the use of EfW incineration, through a combination of recycling and composting.
Indeed the reaction from the majority of local authorities interviews was that the requirement was to achieve recycling targets, and recovery targets were largely ignored: the only real effort being put into achieving them was from the contribution that recycling was making. Indeed when Norfolk County Council was interviewed, the response received was one that plainly stated that it was not in the authority’s interest to specifically meet recovery targets, and any recovery that was achieved would be through the general recycling and composting programme. These recycling and composting programmes would not however be implemented to such an extent that they would aim to meet the recovery targets. The reason behind this decision is probably the amount of landfill that remains within Norfolk. It is capable of talking 80% of the country’s waste until 2010, providing a far cheaper option, than the development of any EfW facility (Norfolk County Council 2003). This contrasts sharply with Bolton Metropolitan Borough, who have invested a great deal of money into developing their EfW facility. However this is as a direct result of landfill running out, and there being a necessity to find an alternative option of waste disposal (Cunliffe 2003).

However, the case of Norfolk County Council is not an isolated one, with both Cumbria County Council and Leicestershire County Council, taking similar stances against the implementation of any EfW facilities, and attempting to rely upon recycling and composting to help achieve, or make progress in achieving the recovery targets. Indeed many local authorities have ignored, and distanced themselves from the recovery target, despite the critical responsibility that they have to help contribute towards their achievement.

However, Nottinghamshire County Council, the first local authority to implement EfW technology within its waste management programme, has taken a different stance, and currently achieves 37% recovery, mainly through EfW. From an interview with Nottinghamshire County Council, the officer revealed that from the 2002/2003 statistics, Nottinghamshire produced 132 000 tonnes of waste, of which around 23% was disposed of through EfW incineration. Similar to the case with South Tyneside, this is not through a lack of landfill, as they stated, “there is sufficient landfill capacity for a further 10-12 years” (Moody 2003). Despite the near achievement of the 40% recovery target by Nottinghamshire, they are still a long way off achieving the recycling target, with currently only around 9% being recycled.

However, the case with Nottinghamshire County Council is not that EfW is removing much material from the waste stream that would in many instances be recycled, due to a “cap” on the
amount of waste that can be disposed of through EfW. Such a case further strengthens the argument that EfW is not, and would not have a detrimental effect upon recycling, if recycling programmes were implemented effectively, and with appropriate funding. Indeed Battaglino (2001) indicates that in 2001, “Nottinghamshire were sure of meeting only half their [recycling] targets”.

However it seems that Nottinghamshire were intent on trying to develop an integrated waste management strategy, that placed equal emphasis upon EfW, recycling and also a large and important role for composting, without making a concerted effort to achieving the short term targets, especially for recycling. Whether this is the correct approach or not, what is important is that it is currently the best BPEO for Nottinghamshire County Council, and through achieving the relatively high recovery rate, they are going someway to making up the shortfall in recycling. However, it must be iterated that an increase in recycling is essential in order to pursue a sustainable approach within the long term.

4.5 Recycling and Energy from Waste

One of the aims of the review of waste management plans, was to discover whether, a high rate of recycling was conducive to promoting EfW. The theory behind this relates mainly towards the commitment that the local authority is showing towards waste management, and employing such systems as Integrated Waste Management, and BPEO. Figure 8, indicates that such a theory is inclusive, and despite only three local authorities in the sample currently employing EfW, Hampshire, Nottinghamshire and Birmingham, it is clear that a high commitment to recycling does not indicate any such commitment towards implementing EfW.
Indeed further to such a theory, an interview with Essex County Council, a local authority with one of the highest levels of recycling, and one of only a limited number with hope of achieving the 2005, 25% recycling target, revealed an opposition towards implementing EfW. A telephone interview with their Recycling Officer revealed that the authority were primarily concerned with meeting the recycling targets, and seemingly everything else was of little concern. The officer, however, stated that “EfW is something being looked into, however there is political opposition from the Conservatives, who, as the ruling party within the local authority refuse any form of incineration to occur” (Gegg 2003). Although this is a single example, it is unlikely to be an isolated incidence, with opposition coming from a range of sources, as will be evident from later discussion.

Buckinghamshire County Council, who also look likely to achieve the 2005 recycling target, display an alternative stance, with the implementation of EfW incineration, along with the implementation of a Materials Recovery Facility (MRF), to provide an integrated waste
management system, that reduces the reliance upon landfill, and follows the waste hierarchy. In initially promoting recycling, they provide a basis around which EfW can be implemented.

Response from the interviews that were conducted with ten of the sample local authorities, also generally indicated a high commitment towards recycling, and to achieving the recycling targets, yet this commitment did not seem to progress towards the idea of implementing EfW. From an interview with Norfolk County Council, on the matter of promoting both recycling and EfW, the answer received was clear, that the commitment was towards reaching the recycling targets, and little else mattered. When asked about how recovery targets would be achieved, there seemed a reluctance to even consider these, and progress would not be specifically aimed for.

Figure 9 shows the current recovery rates for a number of local authorities within the sample. The recovery figure is not something that is made commonly available within WMPs by local authorities, which suggests that it is of low priority to achieve, and therefore little detail is known on how much waste is recovered.

When considering those authorities which currently employ EfW incineration; (Birmingham, London Boroughs and South Tyneside), they all perform relatively poorly in their recycling
rates, (see figure 8), with all achieving recycling levels of 10% or under. They score far more poorly than the local authorities who refuse to implement EfW, which could lead to suggest that EfW is in fact detrimental to recycling efforts. However, such a claim is not proven from the results, as well as the NSCA report (2001), which believes that recycling and composting can indeed be optimised within an IWMS that includes EfW incineration. Likewise Porteous (2001, p.163) states, “it is worth pointing out that EfW [incinerators] can cope with any level of recycling”, there just needs a balance to be struck between recycling and EfW.

Further to this issue, with an official at Birmingham City Council on such issues, revealed that the authority proposed a “mixed approach to waste”, which relied upon a variety of waste management options (see figure 4). This was partly as a result of the limited amount of landfill that remained for waste disposal. In fact the current statistics for the local authority show approximately 70% of waste was disposed of by EfW incineration, with only around 10-11% being recycled. The officer later indicated that a concerted effort towards recycling was currently being implemented, in order to achieve the proposed mixed, or “integrated” approach (Latimer 2003).

Birmingham City Council is certainly not alone in this position. However it has been forced into it through the lack of available landfill. Given the choice, results of this research show that the majority of local authorities will choose to dispose of their waste through the cheaper option of landfill, and concentrate their efforts on implementing recycling schemes, rather than investigating alternatives to landfill, and then implementing recycling programmes.

The local authority of South Tyneside however, have decided to take such a step. Currently recycling levels are low (only around 10%), with the remaining 90% going to landfill, with a relatively large landfill capacity still remaining. However, speaking to the waste management officer of the authority revealed that the authority are investing in redeveloping the existing Cleveland EfW facility, despite the availability of landfill, as well as undertaking a public consultation exercise, (which has revealed a demand for increased recycling) (Turner 2003).

The only summary that can be made from the research undertaken on the relationship between recycling and EfW is that the link is tenuous. Many local authorities are committed, to achieving their recycling target of 25% by 2005. However, in the majority of cases this leads to the neglecting of the recovery targets, as local authorities do not as yet seem to have developed a
holistic and integrated approach to waste management, and seem content to rely upon landfill as the main route of disposal.

### 4.6 Barriers to EfW development

It has become evident that the reluctance of implementing EfW by local authorities, is a result of a combination of factors; the perceived health impacts, environmental uncertainties from the local authorities, the high cost required to develop such a facility, and primarily the public perception of incineration, which builds into a large body of public opposition.

#### 4.6.1 Public Opposition

Public opposition is the primary barrier to the continued development and implementation of EfW facilities. The interviews undertaken for this study, found that the local authorities of Norfolk, Essex, South Tyneside, Cornwall and Hampshire have all experienced some form of public opposition over the plans for implementing EfW. Therefore, as a result, in the case of Essex, Norfolk and Cornwall County Councils, there has been a reluctance to implement EfW. The opposition exists due to the stigma that is connected to any type of incineration, as outlined within section 2, and the fact that often risks, such as those associated with incineration are socially amplified by public perception, thus causing further opposition towards development (Renn 1998). However there is a need for an improved risk communication to take place, for wherever there is a proposal for an EfW facility (Snary 2001).

Indeed, the NSCA report, “public acceptability of incineration” (2001) notes that the need for public consultation and information provision, are highly important process that need to be developed. However, the development of trust between the public as a whole, and between various other important stakeholders is essential if public opposition in this area is to be reversed. Involvement is the most appropriate way of building a trusting relationship, and so local authorities should look at whether they are consulting with the public enough.

Local authorities may argue that consultation is a costly and time-consuming exercise, with often proves to be unrewarding (NSCA, 2001). However, an approach that recognises that the public play an important role within the development process, and includes effective two way communication, along with highlighting the positive aspects of EfW, and perhaps most
importantly, the opportunity for the public to have an input into the planning process, and a chance to implement mitigation for the development could prove a way forward (Snary 2001).

These problems are highlighted in the case of a proposed incinerator in Buckinghamshire. From a short interview with a resident in the village of Newton Longville, which is the proposed location for one of Buckinghamshire's EfW incinerators, exemplifies how these anxieties arise. He indicated that there was large opposition towards the scheme, and stated that “as soon as people heard that an incinerator was to be built in the village, there was widespread opposition” (Noy 2003).

The fact is that educating the public is widely regarded as being very difficult, and there is a need to undertake meaningful public consultation, using a ‘two-way’ communicative method, in order to replace the manipulative public relations campaigns that have been the traditional method (Snary 2001). Likewise the development of effective risk communication programmes that convey both the ‘expert view’ to the public, as well as collecting feedback from the public, back to the risk manager, are essential if public opposition is to be changed (Renn 1998).

4.6.2 Cost

The costs involved with the development of an EfW facility arise from a number of sources. As previously discussed, it is likely that some form of public consultation will have had to be undertaken, as a result of public opposition having to be overcome, where money will have to be spent on bringing in environmental and health experts, and also on administration costs. Further more, in the case where the EfW is to be built, rather than simply gaining public opinion from a consultation exercise, the consultation exercise is likely to form part of the Environmental Impact Assessment (EIA) which is required to be undertaken for such projects, under European Directive 97/11/EC, Article 4, parts 9 and 10.

This was the case of the Teeside EfW plant, which is used by the South Tyneside local authority. In this case, an EIA had to be undertaken for the expansion of the facility in order to add a third process stream, to allow for an extra 125 000 tonnes of waste per annum to be processed (Entec UK Limited 1999). The EIA process is not only costly, with the need to employ experts to

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4 Article 4, parts 9 & 10 state; Waste disposal installations for the incineration or chemical treatment as defined in annex IIA to Directive 75/442/EEC under heading D9, or landfill of hazardous waste (9) or of non-hazardous waste with a capacity exceeding 100 tonnes per day (10).
undertake environmental and social assessments but it is also time consuming, and likely to increase the development time (Glasson et al 1999). However, the EIA’s results, providing that they are in agreement with the development, can be used to further inform and educate the general public (Wathern 1988).

In developing EfW cost is an important consideration, and with the added cost of undertaking the EIA, it can become a drain upon capital resources, as Cheshire, Cumbria, Leicestershire, and Warwickshire County Councils, all highlighted within their WMPs. However it is something that can be overcome, as the 12 EfW facilities currently in operation prove. However as is described by Pearce et al (1995, p132), in purely economic terms, “no one waste disposal method is intrinsically ‘good’, rather, each method has to be appraised for its costs and its benefits. Costs and benefits being defined as impacts upon human well-being”. Therefore any decision based purely upon economics, will favour the continued use of landfill, up until the point when the Landfill Tax becomes the more expensive option.

Economic benefit can be gained from EfW though, and despite current questions, on whether EfW qualifies as renewable energy, it is currently classed as renewable energy, and so selling energy produced by EfW, will demand a higher price from energy companies as they seek to reach a target of 12% of generation from renewable sources by 2010 (Siemons 2002). EfW can therefore play a significant role within the achievement of this target (Energy from Waste Foundation 2002).

4.6.3 Health Impacts
The health impacts of EfW were not explicitly stated by local authorities through the interview process, as a factor that they perceived to be a specific barrier. Nor were health impacts stated as major barriers within the waste management plans. In general it is likely that health impacts form the basis of public opposition, as the question of “how safe is safe enough?”, forms the basis of much public opposition, despite the fact that there is a variety of evidence to suggest that modern incineration does not pose a health risk (Porteous 1998, Simmons 2000, Brown 2002). The perceived health impacts still create a barrier to development; one that must be overcome if the actual impacts are not to be overshadowed by perceived ones, thus preventing progress.
4.6.4 Environmental Impacts

Environmental impacts were considered within the context of implementing one waste management technique as opposed to another, i.e. EfW as opposed to landfill. However, it would be fair to assume that the environmental impacts of a single EfW development, would form part of people’s perception, may lead to the forming a negative perception of such a development. The impact of the latter issue has been somewhat decreased, that an EIA will be required for most, if not all EfW facilities that are to built within the UK, and so the possibility of mitigation being implemented, in order to address environmental factors, such as air pollution, noise pollution and visual and traffic impacts may reduce both the perceived and actual impacts of the development. However, within the case of Leicestershire County Council, it was sited within their WMP that EfW did not present an environmentally beneficial option.

In terms of the wider environmental context, many local authorities are already considering BPEO for deciding on the most appropriate waste disposal technique, such as Cornwall County Council, with EfW proving to be the BPEO in a number of instances. Indeed the environment has not explicitly formed a barrier towards development of EfW, but if considered wholly, actually presents the case that EfW should be implemented, from the policy stage of implementing BPEO as a policy tool, down to the project stage of having to undertake an EIA for project development.

Integrating the environment in this way, clearly proposed the need that there is for explicitly implementing Strategic Environmental Assessment within the waste planning and management process, to ensure that whatever technique or process is implemented, is indeed the BPEO.
The way forward for EfW is an uncertain one, due to the continuing public opposition that surrounds it and the difficulties involved in influencing such a perception.

However, from the research conducted for this study, EfW is likely to have a future impact within the majority of local authorities WMPs, as landfill both becomes a finite option, as well as increasingly expensive option due to the increases in landfill tax that will occur, year upon year.

Many local authorities will be forced to find alternative disposal routes for municipal waste, and are likely to identify EfW as the BPEO, as well as the most economically viable option, due largely to the income that can be generated as a result of energy production, as well as the reliability of the technology.

This study has however shown that EfW currently plays a very limited role within local authority WMPs, which indicates a need for the introduction of mandatory achievement of statutory recovery targets. Those local authorities who currently use EfW incineration, are most likely to achieve the 40% recovery target by 2005, where as the local authorities who are not employing EfW, are unlikely to get near achieving this target. In order for local authorities to begin to start developing EfW within their WMPs, there is a need for penalties to start being imposed in order to encourage local authorities to implement EfW facilities, in order to achieve recovery targets.

With the introduction of mandatory achievement of targets, local authorities will need to start addressing the needs to overcome the barriers that are currently preventing the development of EfW throughout many local authorities. This study has found that public opposition forms the greatest barrier to development, however it is based upon factors of health and risk perception. This creates a need for local authorities to develop the pathways for improved risk management and risk communication, as well as introducing further meaningful public involvement within the planning and siting processes.

Alternatively, some local authorities may try to achieve the recovery targets through alternative means, whether this is through increases in the recycling and composting rates, which will be difficult to achieve, or through the implementation of various other developing thermal recovery
technologies, such as pyrolysis and gasification. However, this study has shown that the achievement of recovery targets through solely recycling and composting is largely impossible within the context of many WMPs.

Indeed, the study has shown the long-term inadequacy of many waste strategies, with the failure to develop, and implement an IWMS containing EfW. The development of EfW within an IWMS is key in developing a waste management system that is environmentally and economically sustainable for the long term. EfW becomes a greatly improved technique when implemented within the context of an IWMS, one that aims to manage waste in co-ordination with the waste hierarchy, as well as offering the long term BPEO for waste disposal.

However, this study has identified the potential that exists for EfW incineration, and the role that it can play in developing a modern, sustainable, waste management system. However, it has also highlighted the progress that is required by local authorities to develop EfW as part of an IWMS, in order to achieve government targets, along with the long-term goal of helping to make waste management more sustainable.
Battaglino, C. (2001)

Energy from Waste Incineration: A Viable Option for a Sustainable Waste Strategy
UEA. Norwich.

Bell, J. (1999)

Doing Your Research Project (Third Edition)
Open University Press. Buckingham and Philadelphia


Energy-from-waste incinerators: the problem is public acceptance
IEMA Magazine (February 2002). pp. 21-22

Cohen, B.L. (1998)

Public Perception versus results of scientific risk analysis

Department of the Environment, Farming and Rural Affairs. (2002)

Department of the Environment, Farming and Rural Affairs. London.

Department of the Environment, Transport and the Regions. (2001)

Guidance on Municipal Waste Management Strategies

Department of Trade and Industry. (April 1995)

Department of Trade and Industry. London.


Position Statement

Environmental Resources Management (2002)
   Essex Authorities.

Foxall, C. [4th February 2003]
   University of East Anglia

   Introduction to Environmental Impact Assessment (Second Edition)

Holgate, G. (2001)
   Government Guidelines for Environmental Risk Assessment and Management: an Overview

House of Commons (2000-2001)
   Select Committee on Environment, Transport and Regional Affairs- Fifth Report: Delivering
   Sustainable Waste Management
   The United Kingdom Parliament. London

Lofstedt, R.E. (1996)
   Risk Communication
   Energy Policy. (24, 8). pp. 689-696.
National Society for Clean Air and Environmental Protection (2000)
   Public Acceptability of Incineration

   The acceptability & role of incineration: Why Friends of the Earth campaigns against the
   incineration of household waste
   Waste Planning (37). pp. 2-5.

   The Economics of Waste Management. In: Waste incineration and the environment, ed. Hester,
   R.E. & Harrison, R.M. pp. 131-152.
   Royal Society of Chemistry. Cambridge.

   Royal Society of Chemistry. Cambridge.

Porteous, A. (2001)
   Energy from waste incineration – a state of the art emissions review with an emphasis on
   public acceptability
   Applied Energy (70). pp. 157-167

   Energy from Waste: A Wholly Acceptable Waste-management Solution
   Applied Energy (58, 4). pp. 177-208

Rae, G.W. (1995)
   Recovering Energy from Waste: Emission and Their Control. In: Waste incineration and the
   Royal Society of Chemistry. Cambridge.
Renn, O. (1998)

The role of risk perception for risk management

Sellitz et al. (1962)

Open University Press. Buckingham and Philadelphia

Siemons, R.V. (2002)

How European waste will contribute to renewable energy
Energy Policy (30). pp. 471-475

Simmons, E. (2000)

The Acceptability & Role of Incineration: Environmental Impact of waste to energy plants


Journal of Environmental Planning and Management (45, 2). pp. 267-283


Recovering energy from waste in Sweden- a systems engineering study
Resources, Conservation and Recycling (38). pp. 89-121.


University of Umeå. Sweden.


Thermal Treatment. In: Integrated Solid Waste Management: A Lifecycle Inventory
White, P.R., Franke, M. & Hindle, P. p. 247.
Blackie Academic & Professional. London.

In: The Practice of Strategic Environmental Assessment,
ed. Therivel, R & Partidário, pp. 86-94.
Earthscan. London.

Who's Listening to You?: Media Coverage of Sustainable Development and Local Agenda 21
CSERGE: Norwich

Household Waste Recycling
Earthscan Publications. London.

Warmer Bulletin (49) (1996)
Integrated Waste Management. In: Waste Treatment and Disposal

Environmental Impact Assessment: Theory and Practice

WCED (1987)
Ashgate. Aldershot.

White, P.R., Franke, M. & Hindle, P. (1995)
Integrated Solid Waste Management: A Lifecycle Inventory
Blackie Academic & Professional. London.
Williams, P.T. (1995)
Royal Society of Chemistry. Cambridge.

Williams, P.T. (1998)
Waste Treatment and Disposal

Environmental Statements

Entec UK Limited
Middlesborough, Cleveland. (December 1999).

Personal Communication

Cornwall County Council. (June 2003)
Planning an EfW Facility

Cunliffe, J. (June 2003)
Already Having an EfW Facility
Bolton Metropolitan Borough

Faulkner, J. (June 2003)
No EfW Facility
Cumbria County Council

Gegg, E. (June 2003)
No EfW Facility
Essex County Council

Hampshire County Council. (June 2003)
Planning an EfW Facility
Latimer, S. (June 2003)

**Already Having an EfW Facility**
Birmingham City Council.

Leicestershire County Council. (June 2003)

**No EfW Facility**

Moody, S. (June 2003)

**Already Having an EfW Facility**
Nottinghamshire County Council

Norfolk County Council. (June 2003)

**No EfW Facility**

Noy, J. (June 2003)

**Public Perception of Incineration**
Newton Longville, Buckinghamshire.

Turner, T. (June 2003)

**Planning an EfW Facility**
South Tyneside Metropolitan Borough.
Appendix
<table>
<thead>
<tr>
<th>No.</th>
<th>Type</th>
<th>Local Authority</th>
<th>Recycling Current %</th>
<th>Recycling % Aim</th>
<th>Incineration %</th>
<th>Yes (if EfW occurs)</th>
<th>EfW in WMP</th>
<th>Is there a future for EfW?</th>
<th>Will EfW become part of an IWM scheme?</th>
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</thead>
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<td>36</td>
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<td>Promotion of EfW, yet no development plans</td>
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<td>Y</td>
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<td>Have to use EfW in order to meet recovery targets</td>
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