September 2008

Friends of the Earth

Briefing

Mechanical and Biological Treatment (MBT)

Introduction

In the past, almost all residual municipal waste in the UK - the waste left after recycling and composting - has been landfilled untreated. The European Landfill Directive now means we must reduce the biodegradable fraction of waste we send to landfill, and many councils are instead opting to build incinerators to deal with residual municipal waste. Friends of the Earth has long opposed incineration because it destroys natural resources; it undermines recycling by demanding a steady stream of waste; it adds to climate change; and it causes pollution from air emissions and toxic ash.

A number of other options for dealing with residual waste are now becoming more significant, one of these is a group of technologies called Mechanical Biological Treatment. This briefing explains what these processes are, and what the potential benefits and disadvantages can be.

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Mechanical and Biological Treatment – how it works

MBT is a term that covers a range of technologies to deal with residual municipal waste – ie waste that has not been collected for recycling or composting and has been left in wheelie bins or black bags.

In an MBT facility, the waste goes through some sort of biological and mechanical processes, though the order and precise nature of these processes can vary. If the biological stage occurs before the mechanical treatment, it may be known as biological mechanical treatment (BMT).

The mechanical stage

The mechanical stage often has two main roles:

- in many (but not all) technologies, the waste is broken down into smaller parts, e.g. by shredding
- removal of some recyclable material.

Different mechanical stages will have different environmental performance, for example some approaches will use more energy than others, and some will separate recyclables more effectively than others

The biological stage

In the biological stage the waste is either composted or digested, usually in an enclosed system.

If an anaerobic digestion system is used, it should produce methane which can provide energy for the plant (and possible for export to the grid). For more information on anaerobic digestion, see the briefing at www.foe.co.uk/resource/briefings/anaerobic_digestion.pdf

Some systems take the composted waste and then remove more recyclables, for example plastics where are no longer contaminated by food residues due to the composting process.

What happens to the non-recycled MBT outputs?

MBT reduces the mass and volume of wastes, due to the removal of materials for recycling and both carbon and moisture losses. The amount of reduction is very dependent on the design and characteristics of each plant. For every tonne input to a biostabilisation MBT facility (see below), around 0.6 tonnes will be left as residue[1].

There are two main outputs for MBT residues, with the output type determining how the plant is operated:

As a low quality soil, or to landfill, also known as 'biostabilisation'

- In this case it is important that the mechanical stage(s) remove as much non-compostable material as possible, to avoid contaminating the low quality soil.
- It is also important that the composting stage breaks down biodegradable material

sufficiently that the output meets Environment Agency standards which mean that it won't release significant amounts methane if landfilled.

- Typical uses for low grade soil include land reclamation of brownfield sites and landfill restoration.
- A good process can achieve a reduction in biodegradability of up to 90 per cent[1].

As a refuse derived fuel (RDF), for burning (sometimes called 'biodrying')

- In this case, the aim of the process will be to create a fuel that meets particular specifications, for example how much heat it produces when burnt (its calorific value).
- The focus on calorific value means that the composition of the RDF is important, and may discourage the recycling of materials that burn well, such as plastics and paper.
- Any RDF can only be burnt in a plant that meets waste incineration directive standards, which may limit markets. Sometimes it is proposed that incinerators should be built to burn RDF – this makes no sense in climate terms (see below).
- Friends of the Earth is opposed to production of RDF, as this acts against maximising recycling – the best environmental option – and leads to polluting emissions.
- Friends of the Earth is also concerned that some councils are planning to use MBT to RDF as a way of moving waste from more affluent areas (where an MBT plant is built) to poorer areas (where an incinerator is built to take the RDF from the affluent area).

Size of plants and use in Europe

The capacity of MBT plants can range from 10,000 tonnes per annum (tpa)[2] to large scale facilities of 250,000 tpa[3].

Most MBT technologies have been developed in Germany, but Austria, Switzerland and the Netherlands are also developing markets. Some approaches have been developed in the UK, such as New Earth Solutions composting-based approach. Currently there are more than 70 MBT plants operating in Europe[2].

Potential advantages of MBT

- Even with a successful kerbside scheme in place there will be some recyclable materials in the residual waste - these can be captured by MBT, if this is how the plant is configured.
- It reduces the volume of residual waste and therefore the landfill space taken, thus reducing the cost to the local authority of disposal[4].
- It reduces the biodegradability of the waste, thus reducing the methane and leachate production once the residue is landfilled.
- Landfilling the MBT residue will not count towards a council's Landfill Allowance Trading Scheme (LATS) targets, as long as the biological activity has been reduced sufficiently to

meet Environment Agency requirements (see box on page 5). This means that councils can use such plants to meet government waste targets.

- MBT can enable recovery of items that may not otherwise be collected in household systems (e.g. steel coat hangers, etc.)
- Potential hazardous waste contaminants of the waste stream, such as batteries, solvents, paints, fluorescent light bulbs etc, will not reach municipal landfill sites due to the sorting of the waste prior to treatment.
- The plants tend to be modular. They are made up of small units which can be added to or taken away as waste streams or volumes change. In some plants it is easy to convert the mechanical portion into a materials recycling facility, and the biological portion into a source-separated waste composter.
- Plants can be built on a small scale, which would not drag waste in from a large surrounding area.
- Stabilisation of the waste reduces side-effects at the landfill site such as odour, dust and windblown paper and plastics.

Advantages of biostabilisation MBT with the residues landfilled compared to incineration:

- MBT to landfill is far better than incineration in terms of the climate and the environment
- MBT is inherently more flexible than incineration. If a new technology emerges that can efficiently generate energy from the MBT residues following maximum recycling (though Friends of the Earth currently views this as unlikely), the residue could be diverted to this technology. In contrast, and incinerator will keep using the same inefficient, polluting technology throughout its long life.
- There is less public opposition to these technologies than to larger, less flexible technologies like incineration, so it is generally far quicker to achieve planning and environmental permitting.
- It is quicker to build and start operating facilities. This means that some councils are considering an ‘interim’ contract for MBT, typically 7-10 years in length, to help them meet their 2012/13 LATS targets.
- MBT is cheaper to build and operate facilities. WRAP have found that MBT has a median cost of £53 per tonne, compared to £80 per tonne for modern incinerators[5].
- MBT is able to capture as much recyclable material in residual waste as possible after composting, including combustible material, and take advantage of new technologies to do so. For example, increasing numbers of councils are collecting PET bottles, but not collecting other types of PET. A good MBT plant could theoretically separate all PET materials after composting. However, incinerators require combustible material to operate so it is unlikely that separation of these materials for recycling will be maximised. in particular extraction of combustible materials like plastics after composting. Some councils with incinerators will not collect any plastics for recycling.

Potential disadvantages of MBT

- Some local authorities see MBT as a means to meet recycling rates without the need for the separate collection of recyclables. But the dry recyclables separated out during the process will be of poor quality compared to that collected by kerbside or bring-bank schemes. Poor quality materials are less likely to be processed in the UK, and will fetch a lower value in the market.
- Large scale plants draw in waste from a wide area, contradicting the proximity principle and competing with recycling (that waste management sites should be located so as to reduce the distance that waste is transported).
- MBT plants with long term contracts will tie the hands of local authorities. These contracts may demand a fixed tonnage of waste that could undermine recycling and waste minimisation efforts in the area.
- Some MBT plants are proposing to make RDF.
- If landfilled, the residue is subject to the landfill tax as well as gate fees. There is a campaign to change this (see box on page 6).

Landfilling and LATS

Disposal of biodegradable waste to landfill contributes to climate change through the release of methane, a powerful climate change gas. It also makes no sense to dump recyclable resources in the ground.

The European Landfill Directive was introduced to tackle some of these concerns. It obliges member states to progressively reduce the amount of biodegradable municipal waste (BMW) which is landfilled, setting targets for the years 2009/10, 2012/13 and 2019/20. By 2019/20 the landfilling of BMW should be reduced to 35 per cent of 1995 levels. The government may receive fines from the EU if it misses these targets.

The Landfill Allowance Trading Scheme (LATS) was introduced by the government to help the UK meet these targets. The scheme will penalise local authorities that exceed their given allowances for landfilling BMW.

The Environment Agency has developed a protocol by which to measure the reduction in 'biodegradability' of wastes achieved by MBT facilities. If the residue from an MBT facility meets the required level of stability, they can be landfilled without counting towards LATS targets for landfilled BMW.

For more information on the Landfill Allowance Trading Scheme see the briefing at http://www.foe.co.uk/resource/briefings/lats.pdf

Landfill Tax

Landfill tax is paid on top of normal landfill fees by businesses and councils that want to dispose of waste using a landfill site. It is designed to encourage businesses to produce less waste and to use alternative forms of waste management. Landfill Tax and LATS are two separate schemes.

The standard rate is £32 per tonne in the 2008/09 tax year. The landfill tax accelerator means that this rate will increase by £8 per tonne each year from April 2008 and by 2010 the landfill tax will be £48 per tonne.

Friends of the Earth believes that the government should introduce a lower rate of landfill tax for waste that has been adequately stabilised through an MBT process. This would have a significant impact upon the financial viability of MBT technologies in the UK. A detailed study has been produced by Eunomia consultants examining the environmental and economic justification for such a change[1].

The impact on climate change

Waste disposal contributes towards climate change, for example through the release of methane from landfill sites or the burning of waste.

Friends of the Earth published a report by Eunomia[6] that undertook a detailed analysis of the climate impacts of different residual waste technologies. It found that an MBT process that extracts both the metals and plastics prior to landfilling is one of the best options for dealing with our residual waste, and has a lower impact than either MBT processes producing RDF for incineration or incineration of waste without MBT.

The research is summarised in the 'Dirty Truths' briefing at
http://www.foe.co.uk/resource/briefings/dirty_truths.pdf

For more information on incineration, see the 'Up in Smoke' briefing at
http://www.foe.co.uk/resource/media_briefing/up_in_smoke.pdf

Another recent report by Eunomia, for the Greater London Authority, carried out a similar modelling of the climate impacts of different waste management scenarios[7]. Many of the best performing scenarios were based upon MBT, with AD to produce biogas for energy generation, prior to landfill.

The report's authors noted that "scenarios coupling MBT (AD with maturation) with gas engines (in combined heat and power mode), or with biogas-fuelled vehicles, are the highest ranked configurations which might currently be affordable to local authorities."

They also note that "these scenarios performed particularly well due to MBT or autoclave processes capturing materials suitable for recycling from the waste stream. The results show that recycling, particularly of plastics, makes a considerable difference to greenhouse gas impacts by avoiding emissions from virgin manufacturing processes."

These reports support the findings of previous research[8].

The importance of flexibility

It is important that residual waste technologies are flexible enough to be able to accommodate future changes in waste arisings as recycling rates and waste prevention increase. Figures from Defra indicate that the growth in municipal waste is stabilising - the average annual increase in municipal waste from 2001/02 to 2006/07 was 0.2%.

The new Waste Strategy for England[9] emphasises the need for "flexible - e.g. modular - buildings, and also flexible contracts, which do not lock in fixed amounts of waste for treatment which might become obsolete."

MBT plants can process smaller amounts of waste per annum than incinerators, which usually have much larger capacities. They are also modular and the modules themselves can be flexible - unlike incinerators. Well-designed MBT plants can be scaled up and down to deal with different amounts and types of waste, whereas incinerators require a fixed supply of waste for their whole lifetime.

In a well designed facility, the mechanical module can also act as a materials recycling facility and the composting module can switch between residual waste composting and source-segregated compost.

This flexibility is a key cost advantage of MBT. It also means that authorities procuring MBT will not feel the need to over-provide now with an excessively large facility, on the assumption that there will be massive waste growth over the coming decades.

Case study - New Earth Solutions

New Earth Solutions operates a composting and MBT plant in Canford, Dorset. It cost approximately £4.4 million to build and opened in 2006. The facility is designed to take 50,000 tonnes per year of mixed MSW, and produces around 9,000 tonnes of compost-like output per year.

The plant processes residual municipal waste for Bournemouth Borough Council, which has signed a five-year waste disposal contract with New Earth Solutions. The contract is initially for 10,000 tonnes of waste per year, to be scaled-up to 70,000 tonnes. The output is intended for use in land restoration projects.

New Earth Solutions was the first company to publish the results of tests using the Environment Agency's guidance and to receive approval for a Landfill Allowance Trading Scheme (LATS) diversion monitoring plan. The processes were shown to deliver up to 80 per cent diversion of Biodegradable Municipal Waste (BMW) from landfill, whilst recovering dry recyclables.

The plant also composts source segregated organic waste for Bristol City Council, Surrey County Council, Eastleigh Borough Council, and Asda supermarket.

www.newearthsolutions.co.uk/

A solution to the waste crisis?

The majority of the municipal waste we produce in the UK can be re-used or recycled, and with intensive waste minimisation, re-use, recycling and composting schemes the amount of residual municipal waste that is produced will reduce over time.

Research has shown that high recycling and composting followed by MBT is one of the best ways to treat waste in terms of climate change, and maximizes our resource efficiency. Removal of recyclables should be maximized, then the small amount of waste remaining should be disposed of to landfill, unless sufficiently clean to be used as compost. These processes should occur in small, localised treatment plants.

Proposals for MBT plants that meet these criteria are less likely to be met with public opposition than proposals for incinerators. MBT also has many other advantages over incineration - the technology is more flexible, the plants can be built on a small scale and can be modular in design. They are also cheaper and quicker to build. There is a lack of awareness and understanding of MBT, which offers activists an opportunity to engage with their councils to promote it.

However, Friends of the Earth will not support MBT plants that:

- produce RDF;
- do not maximise the removal of the remaining recyclable waste;
- are built on a large scale;
- are not put forward as part of a waste strategy that involves intensive waste minimisation, re-use and high quality recycling.

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