October 2006

A guide to MBT – The Biological Treatment of Waste

MBT stands for "Mechanical Biological Treatment", sometimes also known as Biological Mechanical Treatment (BMT). Whilst the two different terms tend to differentiate between the order of processes and to a degree outputs, it is generally recognised to group these under the umbrella term of "MBT".

Background.

MBT is a name, which has recently become associated with waste management processes, but as with the word "compost", means different things to different people. MBT is heralded by some as the answer to all their waste management problems and a complete alternative to incineration and by others as an expensive treatment option with limited advantages. The truth, however is probably somewhere in between. This fact sheet is designed to dispel some of the myth in non-technical terms.

It is correct to say that MBT is the name given to cover a number of different processes dealing with the biological treatment of waste. A definition might therefore be:

" A combination of mechanical separation techniques and biological treatment – either aerobic or anaerobic OR a combination of the two – which are designed to extract and /or treat fractions of the waste inputs into the system with specific purposes in mind."

MBT – in its various forms – has been used across the EU over the last 10 years or so, particularly in Germany and Austria, where much of the early development took place, and more recently in Spain and Italy. The recent Juniper study and report on MBT [1], references *"27 companies" (with) … "80 operational facilities which have a combined treatment capacity of more than 8.5 million tonnes per year".*

What is MBT used for?

MBT is primarily considered as a method for dealing with the residues of mixed Municipal Solid Waste (MSW) once the dry-recyclable fraction (i.e. paper, card, plastics cans, glass etc. and to an extent garden waste) has been reduced and in some cases largely removed, through separate collection systems from households. The MBT process is normally considered as a "pre-treatment" for landfill but as technologies improve and legislation becomes clearer, other applications geared more to recovery and recycling may be possible. However, MBT also plays a key role in strategies including separate collection of food waste, since in residuals, a certain percentage of organics may still be found (depending on efficiency of captures). The inherent flexibility of MBT is a key aspect that may benefit strategies, which are planning an increase in the removal of biowaste from the MSW stream through separate collection.

[1] The Juniper report "Mechanical-Biological-Treatment: A Guide for Decision Makers" can be found at: http://www.assurre.eu/uploads/documents/pub-21_en-4ec0bd21-8e60-4ce7-843e-2759f119441e.pdf

How does it work?

The "Mechanical" bit of the MBT process is the key and can mean the success or failure of the biological treatment. Normally the majority of mechanical separation (treatment) takes place at the front end of the process, but can also play a significant part at the back end of the process when further separation or screening of the residue is required. The mechanical separation process can include everything from basic shredding to sophisticated screening and both dry and wet processes. Again it depends what you are trying to achieve.

As an example, if you wish to maximise recycling and/or recovery with the residue going to landfill in a stabilised form then you would choose a process that recovers dry recyclables such as plastics card, paper and metals in as uncontaminated a form as possible. You would also recover some of those materials which may be too contaminated for recycling but still highly suitable as a high calorific value fuel for Energy from Waste (EfW) plants. The remaining waste fraction should, as far as possible be only the "organic" or "biodegradable" element ideal for the biological treatment. Further screening could also take place at the end of the process if your technology is designed to remove yet further contaminates and/or reduce particle size particularly if you are wishing to use the residue for a purpose other than landfill.

In contrast, if the MBT plant is designed to produce a dry-stabilised fuel for EfW plants then you would only look to remove metals, glass and any other "non-burnable" materials. The dry-stabilised material would then become a solid recovered fuel (SRF). This is where some confusion between "MBT" and "BMT" has arisen. The BMT process is designed to "bio-dry" the material with the primary purpose of making a fuel hence this treated material is known as SRF (Solid Recovered Fuel). The MBT front end sorting process will produce material suitable for recycling and biological treatment, but also material that whilst it could go straight to landfill may be best suited for incineration. This material is known as Refuse Derived Fuel (RDF), e.g. it is a recovered fuel which has not been treated. Both "fuels" – which are still considered as waste - are suitable for use in fossil fuel plants, cement kilns etc. However, to enable utilisation in respective industrial processes further processing steps are likely to be necessary (dependent on the requirements of the respective utilisation path).[2]

What about the "biological" part?

The biological treatment part of the process is either aerobic or anaerobic, or a combination of the two. It all depends on the type of waste materials you want the process to deal with, some background conditions (e.g. available capacities for treatment of wastewaters, subsidies for thermal recovery of SRF, etc.) and what you want to achieve by the process. The main thing is that most aerobic and anaerobic treatment processes use known, proven technology. The aerobic process is used widely in other forms more frequently associated with "composting"(see Assurre fact sheet on composting[3]). The anaerobic process is most easily associated with water treatment plants and is described as Anaerobic Digestion (AD).

In this context therefore, neither anaerobic digestion nor aerobic "composting" of mixed MSW will work on their own without some form of mechanical treatment as well.

A typical plant could take material in the form of unsorted residual MSW, which would be screened into the organic fraction, light plastics and paper, and a metal fraction. The remaining material, plastics, cardboard etc. could be used as an RDF in a conventional incinerator or cement kiln. The organic fraction which is dealt with by AD will include energy recovery in the form of biogas, a fact which is often forgotten when referring to the concept of "energy recovery from waste". The residue from the AD process could then be aerobically treated to further reduce volume/weight thereby producing a bio-stabilised material normally destined for landfill or land-spreading in a restricted form.

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[2] The Juniper report: MBT – A guide for decision-makers, discusses the pros and cons of these techniques at some length.

[3] Composting: The treatment of biodegradable waste: http://www.assurre.eu/uploads/documents/pub-10_en-abda7c69-e728-45b6-b10c-e5f643c6ef1b.pdf

As you can see from this example, this whole MBT process is quite complex with a number of variables giving considerable flexibility. The advanced MBT plant can be tailored to your requirements and properly designed can handle a varying waste stream without huge re-investment or re-construction. MBT systems should be of a modular design which can be switched from mixed MSW to process source separated organic materials should a change in collection systems demand. "Double duty" sites (i.e. sites processing both mixed/residual MSW and – to an increasing extent – separately collected biowaste) are quite diffused across Europe, and may provide for a flexible answer to the need to tackle changes of schemes and of local strategies in time.

What about the economics?

Economy of scale suggests that MBT plants should be around 60,000 - 100,000 tonnes per year upwards. Scaling is much less important than with mass-burn incineration, and makes MBT a particularly suited pre-treatment system before landfilling in rural or sparsely populated areas. This is demonstrated by the many sites in the region of 10-20,000 tpa, which are currently operated across Europe in an effective and cost-competitive way. Gate fees can vary around 75 - 150 euros per tonne, including final disposal of residues or treated materials to landfill, and for SRF delivery at EfW sites, which while it compares favourably with incineration, currently in some EU Member States, is still a lot more expensive than landfill.

However when you take into consideration the financial benefits gained by the tonnage reduction set against landfill taxes and the need for landfill diversion, MBT has a lot going for it. MBT also has environmental acceptability particularly for those processes that maximise recycling and recovery and produce either stabilised landfill material or where possible a product capable of low-level restoration or landscaping. The MBT process which is effectively only producing incineration fuel, in whatever form, is less acceptable at the moment as resistance to incineration is still difficult to overcome in many parts of Europe.

MBT plants do not require huge amounts of labour. A 60,000 tonne a year plant might only require 4-5 people to run it. However, this widely depends on the type of process system, namely for the biological treatment section.

MBT plants still require planning permission and are subject to the usual planning material considerations of traffic and loss of amenity. Location for such facilities, as with all waste management facilities, is never easy. However MBT is usually perceived as a more environmentally acceptable route which may well be a factor in its favour.

All MBT plants require permits/licences and are subjected to the usual rigorous monitoring by regulators. Analysis of end products to see if they have achieved what the process set out to achieve will be crucial if the plant is to sustain economic stability. Careful scrutiny of the manufacturer's claims is essential. In the UK, for example, the Environment Agency (EA) have produced guidance on monitoring and assessing reduction in biodegradability in outputs from MBT[4] and other pre-treatments. In Germany they have a similar system, which has been operating successfully for a number of years. Although in theory MBT processes benefit in so much as it may be possible to achieve diversion rates in excess of 80% and upwards this should be balanced against the frequency and complexity of analytical tests required by the EA in the UK to demonstrate "stability" compared with those in other Member States. The UK costs associated with this are estimated at £84,000 per site for the first year reducing to £43,000 in following years.

What to consider when contemplating introduction of MBT treatment facilities

It should be recognised that MBT is not, and cannot be the sole waste treatment solution. A combination of treatment methods is required and MBT must take its place along with

[4] Guidance on Monitoring Mechanical Biological Treatment and other pre treatments to assess reduction in biodegradability of outputs" can be found at: http://www.environment-agency.gov.uk/commondata/acrobat/mbt_1154981.pdf

recycling, incineration and landfill as part of an integrated process of waste management as only landfill, and to an extent mass burn incineration, provide the "one stop shop solution".

Local Authorities must understand that MBT is not a single concept but instead a group of possible elements which can be arranged in a number of different configurations which have different advantages and disadvantages and there exists no such thing as the "best solution". The main challenge with MBT is to find viable uses for the output of the process and to secure long-term take-off contracts. MBT processes which aim to produce a soil-like material from mixed MSW is not expected to find significant usage as compost since it will not meet EU Member State national guidelines for a compost standard and users may be reluctant to use it.

Where does MBT fit within EU Legislation?

In the EU there is no specific legislation that deals with "residues" from biologically treated biowaste. The "so called" Biowaste Directive, where all the relevant issues were supposed to be dealt with, is very unlikely to see the light of day. Although the European Commission will make provisions within the revisions to the Waste Framework directive to establish "end-of-waste" criteria for "compost", it makes no provision for biologically treated residual waste from MBT plants etc. NGOs along with Waste Industry Trade Associations have expressed concerns that lack of clarity in regulation only serves in this case as a disincentive for essential investment in biological treatment plants (see Assurre website for a stakeholder coalition letter to Environment Commissioner Dimas)[5] and they are continuing their efforts to try to convince the Commission to put this Directive back onto the political agenda since such legislation would give much needed strategic guidance for local authorities and waste management operator.

Conclusions

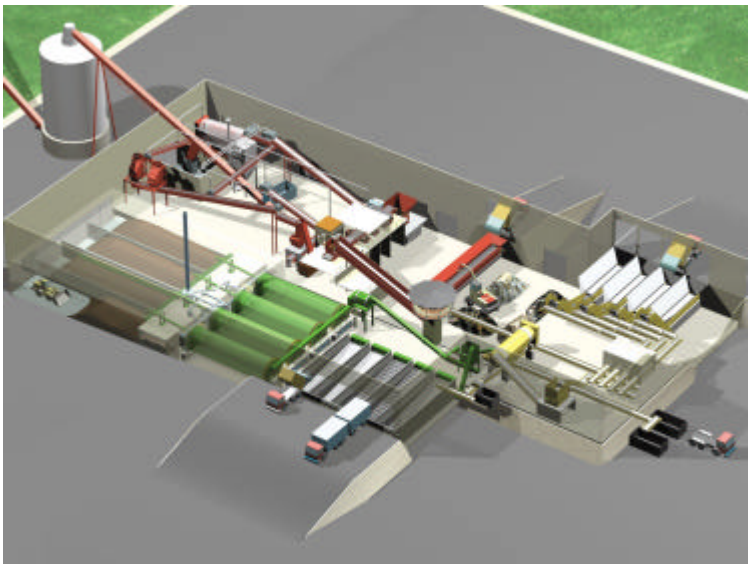
MBT uses proven technology, albeit in varying manifestations of modular designs, but with industry experts expressing differing views depending on their particular preconceptions of the technology, the general public is left without clear and informed understanding as to the suitability of the process that may be proposed in their locality.

In the right legislative environment MBT should be able to develop successfully and whilst the public and politicians may remain demonstrably adverse to waste management facilities because of their very nature, **the "biological treatment of waste" in the form of MBT may prove to be one of the more acceptable pills to swallow**.

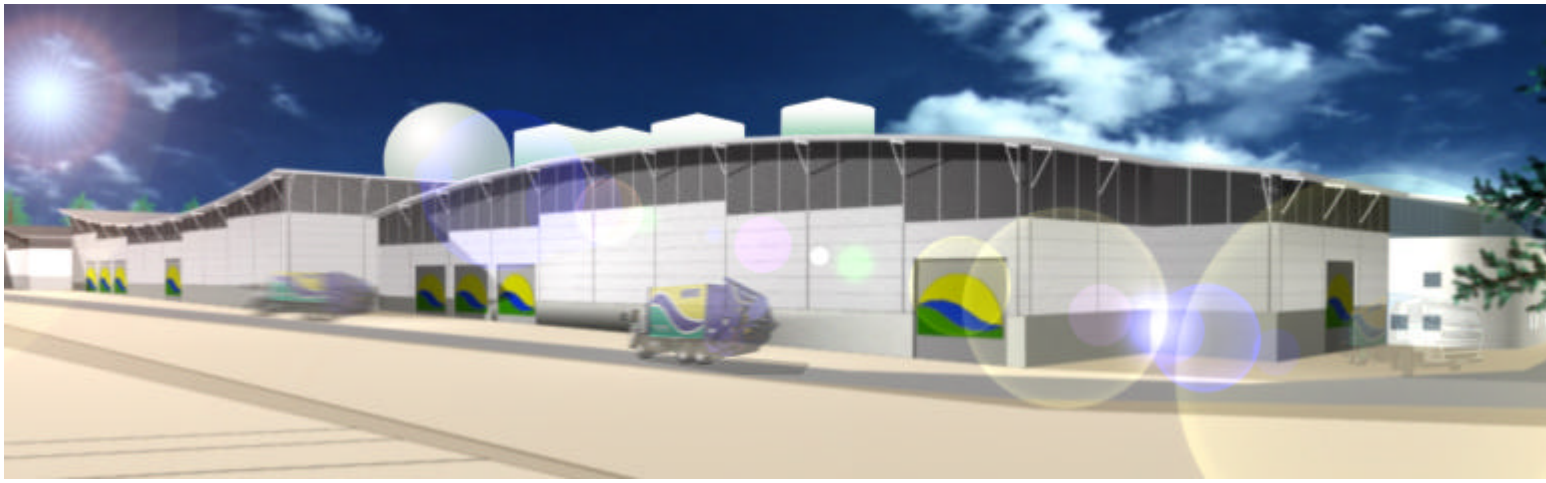
[5] Letter to Stavros Dimas :"Re: The Commission's intention to abandon the proposal for a Biowaste Directive" http://www.assurre.eu/uploads/documents/pub-7_en-2bc6cd4d-bb1c-468f-8793-bd4360bdc6d4.pdf

Existing and planned MBT plants

Existing MBT Plant
DRANCO Plant Brecht II (Belgium)
Operating since January 2000
Processing 50,000 tonnes of biowaste per year



New concept MBT plant – Internal View
from Rumen Oy of Lahti, Finland



New concept MBT plant – A Design developed by Norfolk Environmental Waste Services Limited

DRANCO Digester

Mechanical sorting equipment
Stadler Plant Gielen (Belgium)
Constructed 2003
Sorting 50,000 tonnes of industrial waste per year