

Could MBT Become the Most Significant Waste Management Option?

Dr Egan Archer; Joe Schwager, Dr Kevin Whiting

Juniper Consultancy Services, Gloucestershire, United Kingdom

Abstract

This paper reports on a major year-long worldwide study into Mechanical Biological Treatment (MBT) of municipal waste carried out by Juniper with the support of SITA Environmental Trust through the Landfill Tax Credit Scheme, with additional support from the European industry association, ASSURRE. Juniper's MBT study is entitled - 'Mechanical Biological Treatment: A guide for decision makers - Processes, Policies and Markets' – and includes appraisals of over 30 MBT reference sites in 9 different countries.

Mechanical Biological Treatment (MBT) is fast becoming an important option for treating municipal solid waste in many EU countries that are striving to achieve their Biodegradable Municipal Waste (BMW) diversion targets. They offer ways of converting residual MSW into useful outputs for those that wish to avoid using incineration. But, unlike incineration and gasification of wastes, a large proportion (between 45% and 60% depending on the process) of the input waste to an MBT plant becomes a solid output from the process, which has to be managed effectively.

With new policies being introduced in the waste management and related industries, there are opportunities, limitations and challenges in implementing an MBT led strategy. One key question is can it enable Authorities to meet stringent targets for diverting biodegradable waste from landfill.

Keywords

Mechanical Biological Treatment; MBT; Anaerobic Digestion; Aerobic Composting; Bio-drying

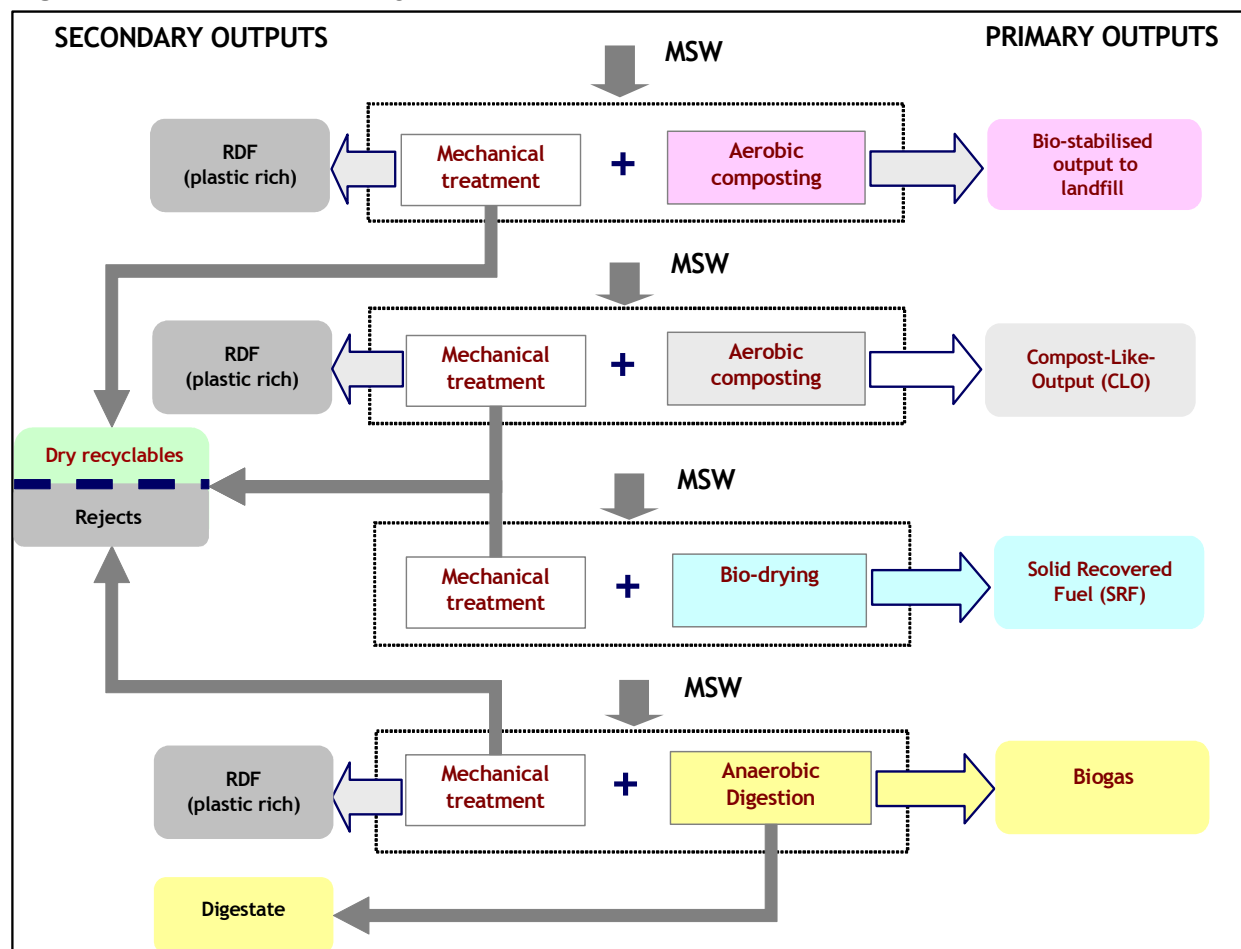
1 What is MBT ?

MBT is not a single concept but, instead, is a family of possible process elements that can be combined in many different ways. The performance of these different configurations varies very widely and each has a complex mix of advantages and disadvantages. Our study found that no one approach is a 'best solution' but, rather, that some types of system will be unsuitable for a particular project, while others can be a very appropriate option.

To highlight the key functional differences between MBT systems, we have classed the various designs into four generic configurations (see Figure 1). MBT processes can be optimised to:

- ⇒ produce a bio-stabilised output for landfilling;
- ⇒ make a compost-like-output (CLO);
- ⇒ make Solid Recovered Fuel (SRF);
- ⇒ produce biogas.

Figure 1: Generic MBT Configurations



Source: Juniper

In addition to the primary outputs for which they are optimised, all MBT plants produce secondary outputs that also have to be managed. For example, a plant optimised to produce biogas will also produce digestate, a plastic rich fraction and an undesirable reject stream.

Practical implementation of MBT is not always as straightforward as illustrated in Figure 1. Many operating facilities combine more than one of these generic designs and may

have more than one type of core biological element in a single process and often more than one mechanical stage.

For example, MBT processes that produce a bio-stabilised output for landfilling or for use as CLO with employ maturation and post refining stages. A number of facilities employ an aerobic composting stage to further bio-stabilise the digestate fraction from anaerobic digestion processes so that the output could be landfilled or utilised as CLO. In a few facilities, the risks associated with managing the process outputs are minimised by using integrated thermal treatment.

As a result, the design of the MBT plant is heavily influenced by the specific nature of the project and the ways in which the outputs from the process are to be managed.

2 Is MBT Proven?

While MBT has only recently attracted interest within the UK, it is not new: MBT systems have been in operation elsewhere for more than ten years.

One third of the technologies reviewed in our MBT study originate from Germany, which is not surprising considering this is where much of the historical development of MBT took place in the context of meeting constraints on landfilling and a desire, in certain States, to avoid the use of incineration.

Having conducted site appraisals of 30 facilities in 9 different countries, we believe that MBT should be regarded as a proven concept. There are more than 80 operational reference facilities that can be attributed to the 27 process suppliers we reviewed in our study, with the facilities having a combined treatment capacity of more than 8.5 million tonnes per year. Two-thirds of the world's combined operating capacity has been installed in Germany, Italy and Spain.

However, because of the numerous ways that MBT plants can be configured and the variety of uses for the output, there may be few directly applicable reference installations for a specific configuration that is of relevance to a particular project.

3 Managing MBT Outputs

The main challenge associated with MBT is finding viable uses for the solid output from the process and securing long-term off-take contracts. For this reason, a significant part of Juniper's study focused upon assessing how practical the different options were. Figure 2 and Figure 3 summarise our analysis of the various potential outlets for MBT outputs in the UK.

Figure 2: Viability of Land/Soil Options in a UK Context

Use	Usability/ functionality	Supply/demand balance	Economics	Regulatory & policy acceptance	Market appetite
Food crops	?	✓	!	✗	✗
Forestry	?	✓	!	?	!
Energy crops	✓	?	?	?	?
Pastureland	?	✓	!	✗	!
Horticulture	?	?	!	✗	!
Domestic gardens	?	?	✓	✗	✗
Liquid fertiliser	!	?	✓	!	✗
Verges & amenity	✓	?	✓	!	?
Landfill cap	✓	?	✓	?	✓
Contaminated land	✓	✓	✓	?	✓
Landfill daily cover	✓	✓	✓	✓	✓
Stabilised to landfill	✓	?	!	✓	✓
✗ potential 'stopper' ! a significant impediment ? less significant but could constrain usage ✓ potentially viable end-use					

Source: Juniper

Figure 3: Viability of Fuel Applications in a UK Context

Use	Usability/ Functionality	Supply /demand balance	Economics	Regulatory & policy accep- tance	Market appetite
Co-fuel for cement kilns	✓	!	?	✓	?
Co-fuel for direct co-firing	!	✓	!	?	✗
Fuel for indi- rect co-firing	?	✓	!	✓	!
Co-fuel for industrial boi- lers	?	!	?	?	?
✗ potential 'stopper' ! a significant impediment ? less significant but which could constrain usage ✓ potentially constraining but not sufficient to adversely impact market viability					

Source: Juniper

Our main conclusion from reviewing the actual situation at key reference plants across Europe are summarised below:

⇒ The output will not find significant usage as a compost in the UK. There are two main reasons for this. It will not meet the UK industry's voluntary quality standard

and, hence, users will be reluctant to embrace it. There will be increasing amounts of compost produced from garden waste, which will compete out the less attractive mixed waste composts produced by some types of MBT process. However, our analysis concludes that there will be a significant amount of usage of the compost-like output (CLO) in other countries as a soil improver.

- ⇒ The study also concluded that the challenges associated with using the output as a fuel are significant – in particular, we identified numerous technical issues associated with such applications. Actual usage in Continental Europe is much smaller than is thought. Unless government policy changes significantly, we expect very little of this product will be used as a co-fuel in power plants.
- ⇒ Our analysis is somewhat more positive with respect to use in cement kilns, but our investigations indicate that cement companies will often prefer other types of waste derived fuel. We have concluded that, because of this competition from other substitute fuels and the limited overall capacity within the UK cement industry, other outlets will also be needed.
- ⇒ We believe that the most practical of these is use as ‘daily cover’ on landfill sites because the market risk, technology challenges and economic uncertainties associated with this application are much lower than other end-uses. For this reason we expect waste management companies to favour it, but, since such use will adversely affect the reported landfill diversion performance of the MBT facility, it is less attractive for Waste Disposal Authorities. Our analysis indicates that the capacity of this outlet is somewhat greater than previously thought.
- ⇒ Where such usage is not possible (for example, in those regions with few active landfill sites) our research has shown that a number of specific land remediation and landscaping applications could absorb large quantities. This, combined with selective land-spreading opportunities (in forestry, for example) can provide more than sufficient viable outlets. We therefore do not believe, as some have stated, that it is impossible to find sufficient outlets for all of the output if the UK were to embrace MBT as its primary method of processing the residual fraction of household waste. However, the policy framework that affects the viability of such applications has significant uncertainties today at both EU and national level. As long as these remain, it may be difficult to finalise waste management contracts that rely on such applications. It should also be noted that it is likely that the operator of the MBT plant may have to pay a fee for access to the end-use, similar to that paid by water utilities for land-spreading of sewage sludge. Our analysis of the economics indicates that this could be economically attractive for all parties, since it would avoid disposal costs.

- ⇒ The concept of bio-stabilising the material and depositing it within a landfill has been promoted by NGOs and others. This approach is being increasingly adopted on the Continent but our analysis has concluded that this option is economically unattractive within a UK context. There are also arguments against such an approach on sustainability grounds. In many parts of the UK, the shortage of void space also predicates against this option.
- ⇒ We have concluded that, in the current policy framework, there are real issues associated with the two most frequently cited applications: use as a fuel in power stations; and use as a compost. A number of other options have been identified which seem more promising but which need further more detailed evaluation. In particular, there are regulatory and policy aspects that require more certainty before the industry is likely to be confident that viable low-risk outlets for the output are available.

4 Costs of MBT

The capital and operating costs of MBT processes vary widely, because of the diversity of configurations. Increasingly, fiscal and trading mechanisms are being used as tools to promote changes in environmental policy. These so-called ‘market distorters’ (examples include landfill tax, ROCs, CCOs, LATS fines, LATS tradable credits and EU-ETS tradable allocations) already play a bigger part than the underlying processing costs in determining the overall economics of MBT – and their importance is likely to increase. Another big factor is whether the output from an MBT facility represents a source of income or a disposal cost. Because these parameters have a significant and variable impact on the economics of specific configurations, the net gate fee for different approaches to MBT will vary markedly. Critics of MBT have said that because it is only an intermediate treatment, the overall costs of an MBT led-solution will always be higher than alternatives. Whilst this will often be the case, we do not think that it has to be in every case. Our analysis indicates that careful design of a project to maximise favourable market distorters could result in projects being viable with little or no gate fee component to their economics.

When one takes into account the complex mix of technical, commercial and policy factors that determine the relative attractiveness of different MBT approaches, our study indicates that MBT configurations that focus on biogas production are often more attractive than the three other options that have received more attention so far: bio-drying to produce an SRF, making a bio-stabilised residue that goes to landfill and producing a bio-treated output that is marketed as a compost. Other options that we believe merit more consideration include making a land remediation material using a ‘fast composting’ type of MBT process and coupling MBT to gasification. In this latter case, using a

closely coupled gasification process increases revenues and removes the market risk associated with the output. The technology risk is greater than with many other options but is less than with gasifying MSW directly.

5 Performance against UK targets

Another major part of our study has been to analyse the performance of MBT against government recycling and diversion targets.

With regard to recycling, MBT only provides a modest increase in the amount of dry recyclables but our analysis indicates that some, but not all, MBT configurations could provide high levels of performance against the key BVPI targets (BV82a & BV82b).

The position with regard to performance against BMW (Biodegradable Municipal Waste) diversion targets is less straightforward. One reason for this is that the UK Environment Agency is currently finalising the methodology that should be used for measuring biodegradability and calculating diversion performance. Under the proposed methodology, it is clear that the performance of different types of MBT process varies markedly but that it is theoretically possible to achieve very high diversion rates. In particular our analysis indicates that a significant proportion of UK Local Authorities may be able to meet their 2020 targets by using particular types of MBT in conjunction with, for example, kerbside recycling initiatives.

6 Summary

One of the prime motives for the development of MBT over ten years ago was to find an alternative to incineration as a route to reducing the amount of biodegradable waste sent to landfill. The current enthusiasm for MBT is predominantly due to a political desire to avoid the use of incineration - regardless of its actual merits as a proven, safe and economic approach to maximising resource recovery from waste when combined with appropriate levels of recycling.

In this context, the findings of Juniper's study with regard to the potential to meet 2020 targets in the UK, without the need for large numbers of new incinerators, are politically attractive. Whether or not it is possible to devise a configuration that delivers on this and which is also commercially viable will depend upon a detailed case-by-case evaluation for each Local Authority.

Widespread adoption of such an approach could allow the UK to meet its overall diversion targets more easily than had previously been thought, given the slow progress that has been made to date on bringing forward the necessary infrastructure.

7 Literature

Archer, E.; Baddeley, A.; Klein, A., Schwager, J.; Whiting, K. (Principal Authors) 2005 Mechanical-Biological-Treatment – A guide for Decision Makers: Processes, Policies and Markets

Author's address

Dr Egan Archer
Juniper Consultancy Services Limited
Sheppards Mill
Uley, Gloucestershire
GL11 5SP
United Kingdom
Phone +44 1453 860 750
Email: archer@juniper.co.uk
Website: www.juniper.co.uk