## CHAPTER 7 - PRINCIPLES OF WASTE MANAGEMENT

*This chapter summarises the main waste management options available to the Region and limitations to their development. The options identified are suitable for municipal wastes and a range of non-hazardous commercial and industrial wastes. The issues related to the development of markets for recyclable materials are also addressed.*

7.1 In assessing the contribution of different waste management options and the future pattern and location of waste facilities, the following factors are relevant:

- the preference for waste management options at the top of the waste hierarchy in accordance with the NI Waste Management Strategy and the Northern Ireland Best Practical Option (see Chapter 2);
- the key environmental constraints that affect the siting and development of new facilities, including land requirements (see Chapter 3);
- the cost of providing facilities, affordability and the impact on the local economy (see Chapter 4);
- public acceptability and social implications (see Chapter 4);
- technical feasibility and operational flexibility;
- optimising the use of existing facilities and the arc21 Region's transportation network.

7.2 To optimise the management of waste in the arc21 Region a combination of waste management options will be required. These options should work in harmony with one another to provide an integrated waste management system and may include some or all of the waste recovery, treatment and disposal options described in this chapter.

7.3 Waste management options can be described using the terms applied in the waste hierarchy. The waste hierarchy ranks waste management options in terms of sustainability and environmental impact. Prevention (at the 'top' of the hierarchy) represents the most favourable option as it aims to stabilise and reduce waste generation whilst disposal to landfill is the least preferred option. This is consistent with European and national policy objectives to reduce the amount of waste disposed to landfill.

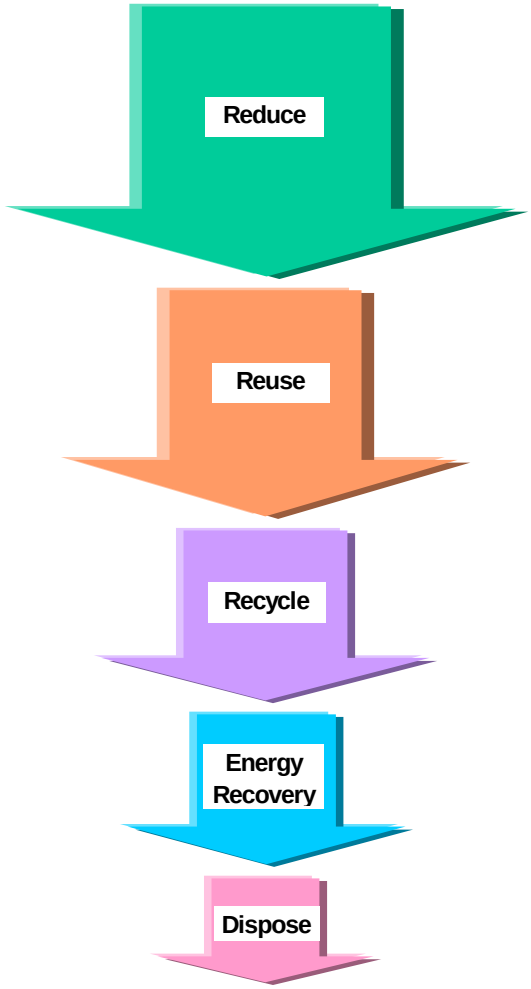



**Figure 7.1 The Waste Management Hierarchy**

**WASTE PREVENTION**

7.4 Prevention addresses waste at its source; by focusing on reducing the quantity and types of wastes produced. Waste prevention is acknowledged as both the most desirable option in the waste hierarchy and the most challenging to achieve and is addressed in its own Chapter (Chapter 6).

**RE-USE**

7.5 The term re-use refers to putting products and materials back into use before they become waste. It involves no physical change in the product and therefore keeps the products in use for longer. The capacity to re-use can be incorporated in the marketing of a product or service – its design, distribution, price and promotion. An example of a product designed for re-use is the supermarket “Bag for Life”, which is very durable and can be re-used over a lengthy period of time.

7.6 Re-using products reduces raw material consumption and energy use and associated costs. It also reduces the requirements for waste collection, treatment and disposal.

7.7 However, re-use can be constrained by technical, regulatory, financial or logistical factors. Not all waste is suitable for re-use and re-use requires commitment from industry, retailers and householders. Re-use is contradictory to the prevailing disposable/throw away society that has developed in recent years in conjunction with low cost mass manufacturing.

**RECYCLING**

7.8 Both recovery and recycling derive value from waste materials and involve reprocessing. Recovery differs from recycling in that it also includes energy production. For example, using wood chip from waste wooden pallets to make flooring panels constitutes recycling, whilst combustion of wood chips as a fuel to produce heat is recovery.

7.9 Recycling conserves natural resources and can save on waste disposal charges. It usually requires less energy than the use of virgin materials and reduces the demand for landfill. Recycling creates new opportunities of employment in areas of collection, treatment and reprocessing of recyclable materials particularly where new uses and applications for materials can be developed. Markets for recycled products need to be further developed and the demand for recycled products increased. Demand for products made of recyclable materials can be low due to the perception of poorer quality and in some cases more expensive final products. An overview of current markets for recyclable materials and the initiatives been taken in Northern Ireland to develop new markets is provided later in this chapter. arc21 has made significant progress in the development of recycling for municipal wastes since the publication of the waste management plan in January 2003.

## Collecting and Sorting Recyclable Materials

7.10 There are a number of collection and processing systems available to promote greater recovery and recycling of waste materials. The main dry recyclables for which markets can be developed are paper, glass, certain plastics, textiles and cans. Additionally, organic waste can be biologically treated to produce a compost or similar product. The simplest way to obtain recyclable materials from waste is to collect them as segregated materials before they are mixed together. This applies to both municipal and commercial waste streams.

7.11 There are several ways to separate and collect recyclable materials:

- ***Kerbside collections:*** recyclable materials are separated by the householder and collected at the kerbside. Kerbside collections can be carried out at the same time as normal refuse collection but recyclable materials are normally placed in a separate container. Separate kerbside collections can vary from collection of dry recyclables and the remaining waste, to provision of a '3-stream' collection system for segregated organics, dry recyclables and residual waste. The term 'kerbside' tends to be used to cover a range of collection points, some councils refer to 'door to door' collections and in others the collection point is the boundary of the property. Materials collections normally encourage householders to deposit a mixture of dry recyclables into a dedicated wheeled bin or to deposit a more select group of materials into a box. These systems generally collect the same materials but in the former, materials are sorted at a facility such as Materials Recovery Facility (MRF) and in the latter materials tend to be sorted at kerbside.
- Additionally, householders can take their recyclables to ***bring banks*** or drop-off facilities or to a ***civic amenity*** (CA) site or a ***Household Waste Recycling Centre*** (HWRC). Bring banks are usually unstaffed and located at points the public already travel to, such as shopping centres. CA/HWRC sites are dedicated (usually staffed) facilities where garden waste, dry recyclables, bulky and hazardous household wastes can be deposited.
- In these cases the recycling is generally referred to as **source segregated** recycling.

7.12 Comprehensive kerbside segregation and collection schemes can recover up to 50% of paper, 50% of glass, 20% of textiles, 15% of plastic, 15% of cans and 50% of organic waste. Well developed bring bank systems can recover approximately 10% of the household waste stream, while kerbside schemes relying on the voluntary participation of householders can achieve overall recovery rates of up to 40% of the household waste stream. CA site recovery programmes generally achieve a diversion rate of 50% although some can reach 70%.

7.13 The original arc21 Waste Management Plan included a Best Practical Environmental Option (BPEO) evaluation. The preferred scenario for arc21 included a "3 stream" collection of organics, dry recyclables and residual waste. Since publication of the Plan in January 2003, arc21 District Councils have successfully implemented kerbside and bring recycling schemes (details in Chapter 5) which include:

- A co-mingled kerbside collection of dry recyclables (bin scheme). Materials collected include: paper, card, plastics, textiles and metal. The materials are collected in a wheeled bin and are sorted at a MRF.
- A co-mingled kerbside collection of dry recyclables (box scheme). Materials collected include: paper, card, plastics, textiles, metals, glass and old hand tools. The black box scheme has been targeted at households where there is not

enough space to keep three separate bins. The materials are sorted at kerbside and bulked up at a MRF.

- Increased provision of bring and glass banks to enhance householder access to glass recycling
- Improvement of CAs/HWRCs for the benefit of all residents.

Details of the number of households served by these schemes are provided in Chapter 5.

### Processing of organic wastes

7.14 Organic waste can be treated by either of two biological processes – aerobic and anaerobic[1]. Aerobic processing, more commonly known as composting, is recycling of the organic fraction of waste in the presence of air, whilst anaerobic processing is a recovery process in the absence of air (this is dealt with in the recovery section). The composting of kitchen and garden wastes has the potential to be a major factor in achieving the recycling and targets for municipal household waste anticipated in the Northern Ireland Waste Management Strategy.

7.15 Key sources of organic wastes include: garden waste, kitchen waste, organic waste from food processing businesses, institutions or hotels, timber and agricultural waste, wastewater and water treatment sludges, and low grade paper waste.

7.16 Composting is a biological process in which organic waste is broken down by the action of micro-organisms and involves the following steps:

- Shredding/chipping – mainly of garden wastes
- Composting – in open or enclosed vessels for a number of weeks
- Maturation – to stabilise the compost product for several months
- Post-processing – to remove contaminants and to screen the product prior to use

7.17 There are a number of composting methods:

- ***Home composting*** – individual householders can compost in their own gardens by placing garden and kitchen waste in compost heaps or dedicated containers. This activity is encouraged by many of the arc21 councils as it avoids the need to collect and treat the waste, and for this reason home composting is often considered as a waste reduction measure. Many Councils offer composting bins to householders at a very competitive price.

[1] Waste Technology Summaries – Enviros Aspinwall October 2000

- ***Windrow*** – one of the simplest and most common forms where organic materials (principally green garden waste) are placed in long piles, known as windrows, and turned regularly and/or aerated through a perforated floor to accelerate composting. In Ireland this system can only be successfully used under cover due to high rainfall.
- ***In-vessel*** – allows the breakdown of waste to happen more rapidly as the organic materials (green and kitchen waste) are placed in specially designed containers, tunnels or bays and composted under enclosed conditions. In particular this approach is now required where kitchen and food wastes are collected separately for composting. This is because of controls that now exist for wastes that may include animal derived foodstuffs.

7.18 Composting produces a useable product as a growing medium or soil improver for agricultural, horticultural and forestry use, or for use in restoration schemes such as closed landfill sites and derelict sites. The quality of compost depends on the quality of the organic wastes used. A better quality product is produced from wastes that have been segregated at source. The EHS[2] has set out guidance which recommends using source segregated kitchen and garden wastes. In addition, composts are now assessed against the British Standard, PAS100:2005[3]. PAS 100 outlines the minimum requirements for: the process of composting, the selection of materials from which compost is made, the process of composting and the quality of composted materials. Input material for PAS100:2005 requires that input materials shall be biodegradable and have not been mixed, combined or contaminated with other potentially polluting wastes, products or materials. This means that the input materials must be organic and source separated. As this is a particular issue for organic wastes from municipal sources, it should be highlighted and emphasised in any long-term waste management education programme.

7.19 There is potential for emissions from composting facilities, which include odour and leachate problems. If not properly managed, there is also some concern about the release of airborne bacteria and fungal spores, although the potential for these emissions is considerably reduced from in-vessel systems and by appropriate management. Increasingly, many new facilities are either in-vessel or housed and this has allowed more control over the compost process, and reduced emissions.

7.20 Sites for composting are subject to planning regulations similar to those for an industrial process and require a waste management licence or PPC Permit. The viability of composting depends on establishing outlets for the products, particularly in the longer term as the volume of compost materials increases.

[2] Waste Management and Contaminated Land: Composting Guidance, EHS, September 2005
[3] Introduction to PAS100:2005, www.wrap.org.uk,

Since development of the Waste Management Plan in 2003, arc21 District Councils have made significant progress in the implementation of the BPEO preferred scenario with regards to segregated organic wastes and composting of wastes collected from HWRCs and kerbside schemes and includes:

- A kerbside segregated collection of garden wastes (bin scheme). Materials (currently only garden waste) are collected in a wheeled bin.
- arc21 contract to treat organic wastes collected by District Councils. Currently at the procurement stage, this contract is expected to provide an Animal By-Product compliant process, most likely in-vessel composting. Once the contract is let and a facility is available, the organic wastes collected at kerbside will be expanded to include kitchen wastes.
- Garden wastes collected at HWRCs are windrow composted.

7.21 Details of the number of households served by these schemes are provided in Chapter 5.

### Additional Recycling and Composting Opportunities

7.22 The Northern Ireland BPEO sets challenging levels for recycling and composting of municipal wastes. This provides a framework under which all possible source segregated recycling and composting can be considered. Developments in recycling technologies, such as more advanced screening and sorting equipment, has meant that a wider range of municipal waste streams are now suitable for recycling. The municipal waste streams that may be considered for additional recycling include:

- Commercial wastes collected by District Councils
- Household Bulky Wastes
- Street sweepings and litter

### Commercial Wastes

7.23 Commercial waste arisings derive from a wide range of business types and industries and the waste composition varies depending on the type of activity undertaken. Each organisation is responsible for taking measures to ensure that its wastes are managed appropriately. Some organisations employ a District Council to manage the waste on their behalf. The wastes collected by the Councils are treated in the same way as other municipal wastes, and include many materials similar to those already collected from households (e.g. paper and card). Commercial waste therefore offers the opportunity for recycling. A number of arc21 Councils already operate a service to collect recyclables from Commercial customers. A summary of benefits and constraints of targeting these commercial wastes is provided in Table 7.1.

**Table 7.1 Commercial Wastes - benefits and Constraints**

| *Benefits* | *Constraints* |
|---|---|
| • Easy 'add on' to existing segregated kerbside recycling collection systems<br>• Potential for additional revenue to offset costs of implementing scheme<br>• Encourages commercial organisations to move up the waste hierarchy. This may also encourage more recycling at home<br>• Segregation of materials increases recycling rates | • Commercial organisations produce variable waste types which may not all be suitable for a recycling scheme<br>• Number of participating organisations may fluctuate making it difficult to programme the appropriate level of service<br>• Difficulties encouraging participation of commercial organisations in the first place<br>• The volume of waste produced by commercial organisations fluctuates<br>• Customers are charged for waste collection |

## Household Bulky Wastes

7.24 Most Councils offer a bulky household waste collection to assist residents with the disposal of large household items. These typically include, furniture, mattresses, carpeting and ovens and other large appliances. Many of these materials offer potential to be recycled and these can make a contribution towards recycling and landfill diversion targets. A summary of benefits and constraints of targeting these bulky household wastes is provided in Table 7.2.

**Table 7.2 Household Bulky Wastes - Benefits and Constraints**

| *Benefits* | *Constraints* |
|---|---|
| • Would target materials already recycled through bring and some kerbside schemes<br>• Potential to provide a significant tonnage contribution to recycling targets<br>• Removes potentially difficult waste stream from residual wastes sent for treatment (e.g. mattresses not suitable for energy from waste treatment plants)<br>• If separate hazardous and non hazardous collections are to be carried out then the same vehicle may be used on different days<br>• If a storage area is available refurbishment of some items may be possible<br>• Jobs would be created if the Council sets up community groups to carry out refurbishment of bulky items | • Large items may be difficult to process through existing infrastructure<br>• Additional transport may be required to deliver materials to appropriate facility<br>• Either a storage area is required to allow the goods to be assessed or an assessor has to go out on the collection round to assess the items<br>• Separate collections of hazardous and non hazardous household bulky waste are required<br>• The majority of household bulky waste disposed of is unsuitable for reuse<br>• Possibility of items getting damaged on collection and during transportation<br>• Cost of collection |

### Litter and Street Sweepings

7.25 Litter and street sweepings are collected by street cleansing services operated by each District Council. Street cleansing services provide regular mechanical and manual sweeping of all adopted roads within a Council area on a scheduled basis. Every road is usually swept at defined periods, depending on the location of the road. Busy High Streets will be swept much more regularly than quiet residential roads, and very busy shopping areas, such as the Centre of Belfast may be swept regularly throughout the day.

7.26 Collection of street sweepings normally involves manual sweepers removing litter and rubbish from the pavement or grass verges. They also remove larger items of litter from the gutters. Mechanical sweepers are used to clean the gutters and roadways. On-street litterbins that are provided in most town centres are emptied regularly by dedicated street cleansing crews.

7.27 Street sweepings can contain a large proportion of packaging materials (e.g. metals cans and plastic drink bottles) and newspapers that can be recycled, along with other similar recyclables already collected by the Councils. In addition, a large proportion of the general street sweeping material is potentially suitable for composting and can complement existing composting systems.

7.28 Some arc21 Councils have already introduced schemes targeting litter and street sweeping wastes through the introduction of compartmentalised litter bins. A summary of benefits and constraints of targeting these street sweepings and litter wastes is provided in Table 7.3.

**Table 7.3 Litter and Street Sweepings - Benefits and Constraints**

| *Benefits* | *Constraints* |
|---|---|
| • Some additional contribution to recycling targets<br>• Opportunity to raise public awareness of waste hierarchy and recycling, for example through segregated bins and advertising on collection machines and vehicles<br>• Large proportion of litter and street sweepings is garden waste and putrescibles, and the majority comprises fines which can all be composted. The compost should conform to BS1 PAS100 standard<br>• On average a composting rate of 70% may be achieved from litter and street sweepings | • Overall impact on recycling rates may be minimal<br>• Some of recyclable materials may be of poor quality<br>• Litter collected from bins very often has high contamination levels |

**Residual Waste Household Waste Recycling Centres**

7.29.1 CAs/HWRCs are provided by District Council's for members of the public to deposit a range of waste for recycling as well as mixed waste. They generally do not accept waste from businesses. There are a number of opportunities for additional recycling of residual waste collected at CAs and these are detailed in Table 7.4 below.

**Table 7.4 Residual Waste HWRCs – Benefits and Constraints**

| *Benefits* | *Constraints* |
|---|---|
| • Introduction of HWRC's within District Council areas can have a positive effect on recycling rates.<br>• Opportunity for members of the public to recycle their waste (free of charge)<br>• Designated areas segregate different types of materials<br>• Reduces the impact on residual waste collection services<br>• Staff on site can help the public segregate their waste and also educate and advise them | • Relies on the public using the facility<br>• Site maintenance and general running costs<br>• Transport movements of a large number of vehicles within the local area<br>• Visual pollution<br>• Noise pollution<br>• If not properly managed the waste storage areas may encourage vermin onto the site |

## RECOVERY OPTIONS

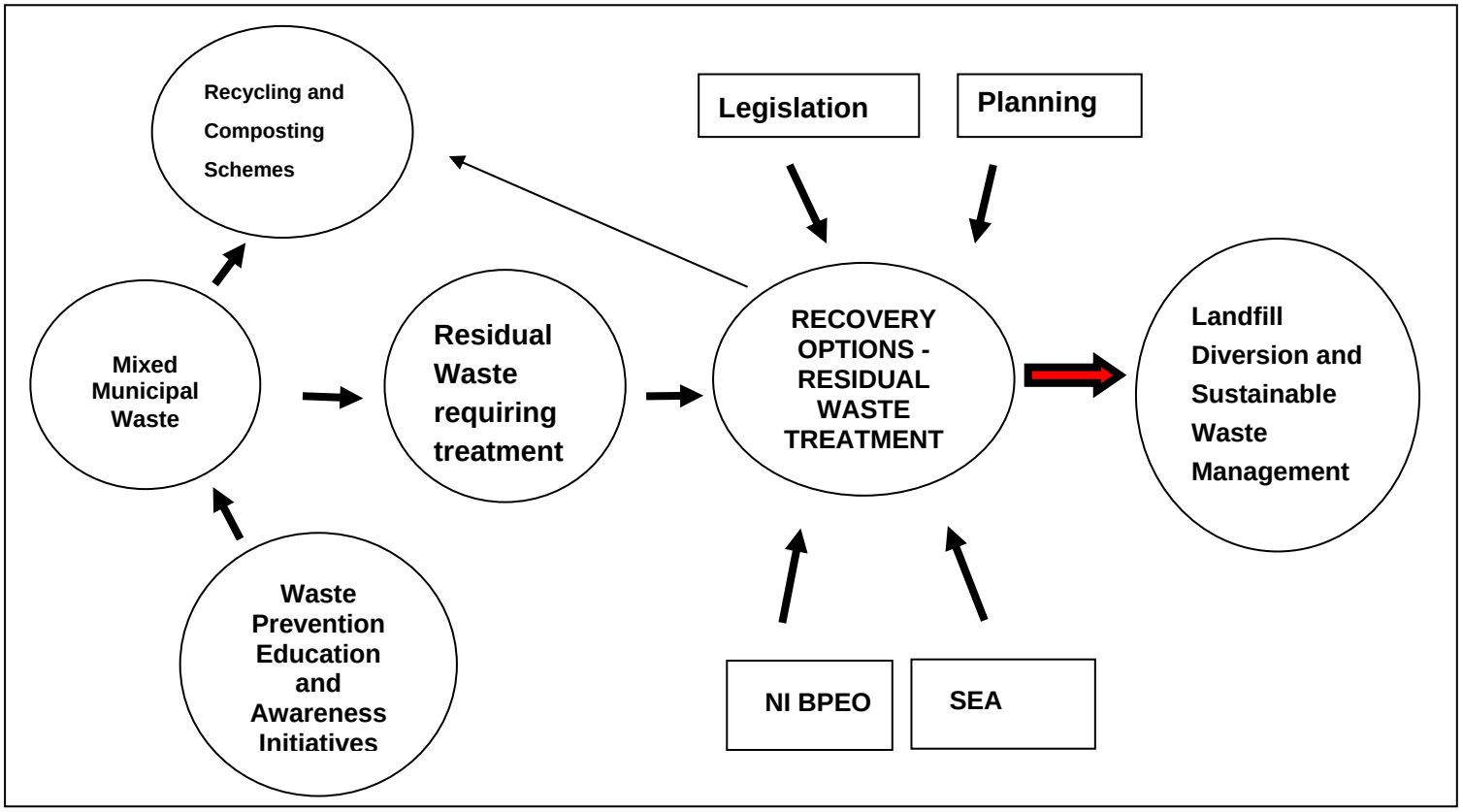
7.29 Recovery options include biological, physical and thermal treatment with energy recovery (i.e. energy from waste). These options are increasingly provided as hybrid processes that combine biological and physical treatment such as Mechanical Biological Treatment (MBT). Recovery needs to be considered as part of an integrated waste management system as illustrated in Figure 7.2. Priority is given to options higher up the waste hierarchy (i.e. waste prevention, recycling and composting). Recovery from residual waste will continue to play an important role in delivering maximum diversion of wastes from traditional disposal methods (i.e. landfill).

7.30 Treatment technologies for residual waste must be able to encompass the following:

- Suitable for municipal solid wastes
- Residual treatment technology needs to allow recycling from the residual waste stream (should not preclude recycling options)
- Be capable of stabilising organic fraction of wastes and/or recovery of energy from wastes

- Be capable of diverting BMW from landfill to meet the requirements of EU Landfill Directive / NILAS
- Be proven and cost effective
- Be highly flexible to deliver the project goals throughout a 25 year contract
- Be compliant with legislative requirements and environmentally acceptable

**Figure 7.2: Recovery Options within an integrated waste management system**



7.31 The treatment technologies that are available for recovery of residual wastes are summarised in Table 7.5.

**Table 7.5: Summary of Recovery Options**

| Biological Treatment | Physical | Thermal Treatment |
|---|---|---|
| • MBT – Composting<br>• MBT - anaerobic digestion<br>• Biological Mechanical Treatment (BMT) – biodrying or stabilisation | • Mechanical Heat Treatment Steam autoclaving | • Incineration with energy recovery (Moving Grate, fluidised bed, rotary kiln)<br>• Advanced thermal treatment – Gasification<br>• Advanced thermal treatment Pyrolysis |

7.32 Within the biological treatment options are a number of different processes that are often referred to as MBT. The main difference between the types of MBT process lies in the order of mechanical and biological treatments and the biological process that is included (i.e. aerobic or anaerobic composting). These are discussed in more detail below.

## Biological treatment

7.33 Biological treatment of organic wastes in controlled conditions is similar to composting in that it reduces the biodegradable content of the waste and produces a soil conditioner/compost, but with the added benefit of energy production.

### Mechanical Biological Treatment (MBT) - Composting

7.34 MBT involves the mechanical sorting and separation of residual wastes with in-vessel and windrow maturation for the separated organic fraction of the wastes. Initially residual waste is treated through a mechanical Treatment system which comprises the following:

- Removal of bulky objects
- Initial shredding and screening of the waste
- Extraction of metals for recycling
- Separation of an oversize fraction which can form an RDF or be landfilled
- Separation of undersize material which can be composted

7.35 In most cases the undersize material is sent for composting. Composting normally takes place in an in-vessel composting system, often followed by open windrow or aerated static pile maturation, to stabilise the material and fulfil requirements of legislation for composting of mixed wastes. A generic process diagram is provided in Appendix 7a.

7.36 MBT systems incorporating composting represent the most established system of MBT for the treatment of municipal residual wastes with a wide range of suppliers in the world market and increasing number of companies offering services in the UK.

7.37 The systems offers the opportunity to recover additional recyclable materials such as ferrous and non-ferrous metals, glass and aggregates which can all count towards recycling targets. There remains uncertainty over other outputs from the process such as the stabilised material and refuse derived fuel fraction for which markets are less certain.

7.38 Depending on their size, MBT plants can require a significant footprint in terms of land requirements. In addition, taking into account the range of materials that are separated out by these processes and the residence times required to comply with regulations, these facilities could have a significant energy requirement with corresponding cost implication. The level of mechanical separation required will also impact on the operating costs of the facility. Table 7.6 summarises the key waste and energy policy benefits and constraints that currently surround use of MBT.

**Table 7.6: Benefits and Issues of MBT**

| Benefits | Constraints |
|---|---|
| • UK energy policy indicates support for local energy generation in part from local waste. It is considered that this could include MBT.<br><br>• Suitable for untreated MSW.<br><br>• Technologies eligible for funding under the and New Technology Demonstrator Scheme | • Compost fraction from MBT is highly unlikely to comply with PAS100 and therefore alternative outlet would be required.<br><br>• Not directly eligible for NI Renewable Obligation Certificates (ROCs) as it does not produce electricity. If RDF produced is used in gasification/pyrolysis (now also for conventional Energy from Waste if Combined Heat and Power) will be ROC eligible<br><br>• Uncertainty over outlets for RDF. Requires update of Waste Framework Directive as indicated by communication on EU Thematic Strategy and recommended by DEFRA Consultation on review of Waste Strategy 2000. |

**Mechanical Biological Treatment (MBT) – Anaerobic Digestion**

7.39 MBT systems with anaerobic digestion have a similar process to the MBT – In vessel technologies but employ anaerobic digestion to treat the separated organic fraction. Mechanical treatment of the residual waste is required to prepare a feedstock for the anaerobic digestion process. Initially residual waste is treated through a mechanical treatment system which can:

- Remove bulky objects;
- Reduce the particle sizes of the waste;
- Extract out some recyclables i.e. metals;
- Produce an RDF for energy recovery in an Energy from Waste, Gasification or Pyrolysis facility, or co-fired in an existing facility, such as a cement kiln; and,
- Produce waste derived compostable organics for treatment in the AD facility.

7.40 Anaerobic Digestion is the decomposition of organic wastes by bacteria in the absence of oxygen to produce a 'digestate' (biosolids and liquid) and a biogas. Residual waste is initially treated through an integrated mechanical treatment system as described above. The waste derived compostable organics are treated in an Anaerobic Digestion facility, which is part of the integrated system with the mechanical treatment. This facility is fully enclosed and operates under controlled conditions at high temperatures to produce a product more quickly than conventional composting processes. For example, a waste derived compost suitable for land spreading and a methane rich biogas which is combusted for electricity production on site. The AD process is ABPR (Animal Bi-Products Regulations) compliant, and hence is suitable for processing non-source segregated organics. A generic process diagram is provided in Appendix 7a.

7.41 Anaerobic Digestion processes can accept a wider range of organic waste streams than in-vessel composting processes which can include agricultural and food industry wastes. As discussed, the anaerobic process produces a biogas which can provide a form of renewable energy generation and therefore has the potential to attract Renewable Obligations Certificates which will provide an additional revenue stream.

7.42 Anaerobic Digestion plants for mixed municipal wastes are a net user of water and the process will produce significant quantities of waste water that can be equivalent to the organic material used in the process. Untreated mixed municipal wastes are also unsuitable for anaerobic digestion without prior screening and sorting, and there will always be a requirement for pre-treatment. The overall land area required will have a significant footprint similar to an MBT plant. Table 7.7 summarises the key waste and energy policy benefits and constraints that currently surround MT AD.

**Table 7.7: Benefits and Constraints of MBT AD**

| Benefits | Constraints |
|---|---|
| • Gas from AD likely to be eligible for ROCs and also potential for funding under the and New Technology Demonstrator Scheme<br><br>• UK energy policy indicates government support for developing AD for treatment of MSW. | • The mechanical pre-treatment process will prepare organic material ready for anaerobic digestion but will also result in an RDF type fuel (unsuitable to pass through AD). The RDF will require another outlet and at present these are uncertain.<br><br>• Requires update of Waste Framework Directive as indicated by communication on EU Thematic Strategy and recommended by DEFRA Consultation on review of Waste Strategy 2000.<br><br>• Compost for maturation unlikely to comply with PAS100 standard and alternate outlet would therefore be required. Treatment of source segregated organics is preferred by regulators and more likely to achieve composting standards. |

**Biological Mechanical Treatment (BMT) – Biodrying**

7.43 BMT systems are again similar to the MBT with composting process. The main difference is that residual waste is normally subject to the biodrying process first with recyclables and other recoverable fractions removed at the end of the process. The main steps for treatment of residual MSW through a Biological Mechanical Treatment system comprise:

- Initial shredding of wastes
- Biodrying of shredded wastes in containers or platforms which reduces the bulk of the waste by drying it, therefore degrading some organics.
- Extraction of recyclable materials in the residual waste (metals and possibly glass).
- Screening of wastes to remove compostable organics which can be treated in either/or composting plants and/or anaerobic digestion facilities.
- Remaining high calorific fraction which can be manufactured into a solid recovery fuel (SRF) or refuse derived fuel (RDF) for energy recovery. The RDF is combusted and energy recovered in an energy from waste treatment process. A generic process diagram is provided in Appendix 7a.

7.44 BMT processes do not fully compost wastes treated by the process and therefore can have a shorter residence time than MBT processes. The output material may have a lower overall biodegradability reduction and can require additional composting before it can be considered for a range of applications.

7.46 The key waste and energy policy benefits and issues surrounding BMT are essentially the same as MBT and therefore the main points are summarised in Table 7.7.

## Physical Treatment

### Mechanical Heat Treatment

7.47 Mechanical Heat treatment (MHT) or autoclaving applies thermal drying technology using autoclaving and sterilisation equipment. Autoclaving allows more waste (than MBT approaches) to be sterilised and converted to a form where different materials fractions can be separated for reprocessing or re-use. MHT is classed as a physical treatment process as, unlike MBT, there is no biological stage in the process. Residual waste is treated through a series of interconnected steam conditioning vessels (autoclaves) to produce a sterile product that can be further treated to extract materials and stabilise the waste. Autoclaves are pressure vessels that are similar to those used in hospitals to sterilise surgical instruments but are much larger and have unique patented characteristics.

7.48 The main stages of MHT comprise:

- Unsorted residual bagged waste is introduced directly into the vessels, and steam and pressure is applied at over 140$^{o}$C for around 1 hour;
- Vessels are rotated and this, combined with the steam pressure, results in the organic fraction of the waste being broken down into a fibrous biomass (flock);
- Inorganics (glass, ferrous and non ferrous metals, plastics and textiles) are sterilised and steam cleaned; and
- Output materials are then mechanically separated into recyclables for recovery,
- An organic, higher calorific fraction is also separated for energy from waste treatment or as fibre in the manufacture of, for example, fibreboard.

**Table 7.8 Benefits and Constraints of MHT**

| Benefits | Constraints |
|---|---|
| • Suitable for untreated MSW.<br><br>• Can result in recovery of dry recyclable material (glass, cans) that is cleaner than via MBT.<br><br>• Technology eligible for funding under the and New technology Demonstrator Scheme | • Relatively unproven in the UK and not specifically identified by waste/energy policy as potential treatment for MSW. Not directly eligible for ROCs as does not produce electricity. If RDF produced is used in gasification/pyrolysis (now also for conventional Energy from Waste if Combined Heat and Power) will be ROC eligible.<br><br>• Autoclave process does not reduce biodegradability of waste (sterilises waste) therefore process might not fulfil the objectives of waste policy on diversion of wastes from landfill.<br><br>• Possibility that outlet for compost type material would be required, and compost unlikely to meet PAS100.<br><br>• Produces a fibre output with alternative application to RDFs (i.e. as a fibreboard). This is however uncertain and market needs developing. |

### Thermal treatment - Energy from Waste

7.49 Thermal treatment involves the use of heat to either burn or degrade waste under controlled conditions. These processes result in the release of heat energy, a significant reduction in the total volume of waste and significant removal of the biodegradable content. The heat energy created can be used to generate electricity and is often referred to as ***Energy from Waste*** (EfW). The energy can also be used to heat water for heating systems in local business or houses and in these cases the facility can be referred to as ***Combined Heat and Power*** (CHP) facilities.

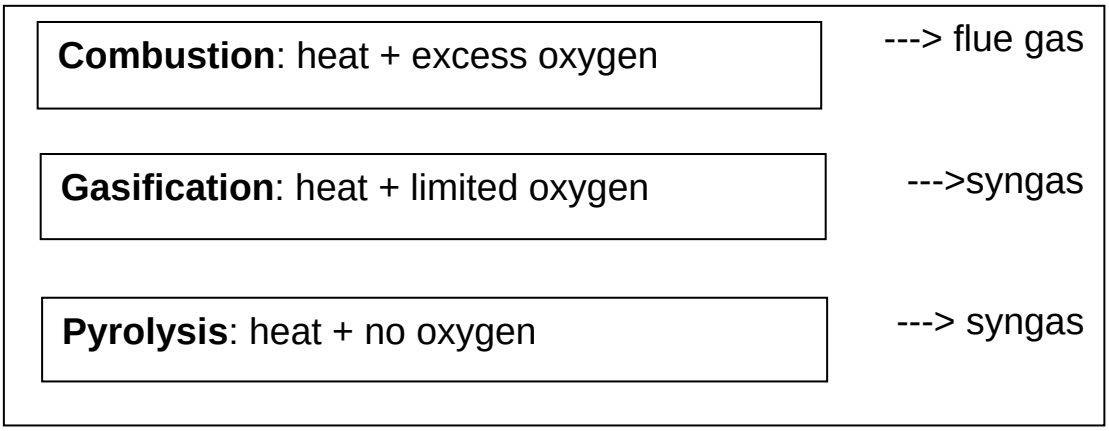
7.50 Energy from waste (EfW) facilities are identified in the NI Waste Management Strategy as being necessary to meet the diversion targets set in the 1999 EU Landfill Directive. The NI BPEO has further identified EfW as part of the preferred mix of treatment for residual MSW [4]. Energy from waste treatment technologies tend to fall into two main categories:

- **Combustion** technologies, such as waste incineration with energy recovery;
- **Advanced Thermal Treatment** technologies such as **Gasification and pyrolysis**

[4] NI BPEO Guidance Document June 2005

The main differences between these processes lie in the amount of oxygen used in the thermal treatment process. Figure 7.3 illustrates these differences and identifies the main output from the process which is used to recover energy.

**Figure 7.3 Summary of Differences in Energy from Waste Treatment Processes**




**Combustion with energy recovery**

7.51 Combustion with energy recovery is the application of sound, proven combustion engineering principles to a variety of technologies which reduces the volume and quantity, and sanitises the municipal waste fraction, after recycling and composting has taken place, in order to recover energy from the input waste material. To date, there are more than 1,000 facilities based on this technology operational around the world.

7.52 Typically, during controlled combustion in the presence of oxygen, the organic component of the waste is oxidised to form $CO_2$ and water, and the solid residues are mineralised into ash. There are a variety of different technologies, (for example, moving grate and fluidised bed) which can, after an initial screening/ sorting process to remove large and oversize materials, produce energy from waste by burning mixed MSW material. Metals are extracted after combustion has taken place, and bottom ash produced can be used as an aggregate. Air pollution control residues produced are deemed hazardous, and whilst some markets exist for its use it is generally landfilled.

7.53 Although EfW is a well established technology capable of treating a range of different waste types, there are a number of concerns relating to its adoption. The capital costs of developing these facilities are high[5] and as such the development of an EfW plant needs to be underpinned by long term contracts that guarantee the operator a continuous supply of waste. For municipal waste this tends to involve local

[5] Capital costs depend on plant capacity, combustion technology and the pollution abatement technology selected, but can range from £40m to £90m for plants of capacity 200,000 tpa to 500,000 tpa.

authorities entering into at least a 20-year contract. Furthermore, due to the high capital cost, economy of scale benefits are realised by larger facilities and hence a lower unit cost per tonne of waste is achieved. In the past this has favoured the development of larger facilities but combustion technologies are now commercially available at a smaller scale (i.e. less than 100,000 tpa).

7.54 There is concern that building a large plant that requires a local authority to deliver a guaranteed tonnage of waste offers little incentive for further waste reduction or recycling once the plant has been established. Evidence from other European countries suggests that EfW can be combined with recycling and composting with no negative effect on recycling performance[6]. Also, studies have shown that the calorific value of the municipal waste remaining after the removal of materials for recycling or composting, is only marginally affected. Recycling removes both combustible and non-combustible materials such as glass and ferrous metals, but some combustible materials such as soiled paper and some plastics are contained in the remaining waste [7]. EfW can contribute to an integrated waste management solution where a key objective is to reduce the total quantity of waste disposed to landfill. It can provide an alternative to landfill without compromising recycling activities as long as EfW capacity requirements are determined taking account of current and likely achievements in waste reduction, recycling and composting.

7.55 It is emissions to the atmosphere and associated risks to human health which have generated the attention of various quarters. Studies have not proven any link between EfW and health, particularly higher than normal incidences of cancer associated with dioxins. Acidic gases (such as sulphur dioxide) and fine particulates are also released from EfW plant and can be a source of respiratory irritation, but impacts are unlikely to be felt directly from EfW plant as they are a small source compared with others (e.g. particulates from diesel engines). The UK review of the health effects of Waste Management of Solid wastes[8] identified that the health risks of a modern EfW plant are small compared with other known human health risks, and that EfW remains an option for dealing with residual waste. The Foreword by Elliot Morley, Minister of State for Environment & Agriculture indicates that the report provides sufficient confidence in current policies for local authorities to press ahead urgently with the task of approving planning applications for new waste management facilities. EfW plants are controlled operations subject to authorisation under IPPC, and all new plants have to meet the increased standards in the Waste Incineration Directive (refer to Chapter 2). Once a plant is operational the Operator is required to monitor emissions using approved protocols and to an agreed schedule. The Regulatory Body is responsible for checking monitoring data and for ensuring a plant operates in line with its authorisation.

[6] *Review of Recycling in Europe*, 2000. Prepared by Enviros for the Resource Recovery Forum.
[7] *An Introduction to Household Waste*, March 1998. Prepared by ETSU for the dti.
[8] Review of Environmental and Health Effects of Waste Management: Municipal Solid Waste and Similar Wastes, May 2004 http://www.defra.gov.uk/environment/waste/research/health/

7.56 Whilst EfW is a proven technology that can contribute positively to an integrated waste management strategy by recovering the energy value of the waste, public opposition to EfW facilities can lead to significant delays being encountered in the planning process. Some of the benefits and issues related to the development of EfW plant are summarised in Table 7.9. A list of operational EfW facilities in the UK is presented in Appendix 7b.

**Table 7.9 Benefits and Constraints of Energy from Waste**

| *Benefits* | *Constraints* |
|---|---|
| • state of the art technologies that are highly regulated and controlled<br>• significant volume reduction (up to 80%) meaning less residual waste and reduced requirement for landfill<br>• potential to meet the recovery targets fully over the Plan period<br>• potential recovery of metals from residues and opportunities to recycle bottom ash<br>• can receive waste 24 hours per day<br>• financial and contract stability, less reliant on markets for secondary materials<br>energy production from a large plant will be approximately 15MW or 1% of NI electricity requirements<br>• addition to energy recovery modern plants now recover bottom ash for use in aggregates and metals for recycling | • high capital investment requiring long term contracts and little flexibility in waste management techniques<br>• planning, licensing and commissioning of facilities can take many years, this means that it is unlikely to contribute to recovery targets in the early years of the Plan<br>• public perception of health risks and general opposition to large facilities<br>• further treatment/disposal can be required for residues, particularly the fly ash which is classified as a hazardous waste |

**Advanced Thermal Treatment - Gasification and Pyrolysis**

7.57 Advanced thermal treatment is used to refer to Gasification and Pyrolysis. These are emerging technologies for the treatment of MSW. There are currently over 80 facilities in operation or under construction worldwide. The facilities tend to be used for the treatment of a single homogeneous waste stream i.e. for tyres or manures. There is increasing interest in these technologies for treating MSW and a number of demonstrator plants are now operating in the UK.

7.58 Residual MSW or fibre/ SRF/ RDF is treated through an Advanced Thermal Treatment process, such as gasification or pyrolysis. When treating 'raw' MSW this generally involves a pre-sorting/ screening process to remove bulky objects or shred the waste. These systems can be built on a modular scale, with a number of modules at a single site, or single modules built at multiple sites.

7.59 Pyrolysis, is a medium temperature thermal process, generally incorporating gasification, in which heat and the absence of oxygen break down organic carbon derived materials into a product similar to charcoal (Char) and a gas (Syngas). MSW is pre-sorted to remove non-organic materials and shredded to produce a homogenised 'feedstock'. Paper, plastics and other organic derived materials are broken down at temperatures generally between 300 – 800$^{o}$C, which produces Char and Syngas. The gas can be condensed to produce a Pyrolysis Oil. The oil or gas can be used as a fuel to generate electricity similar to EfW; it has a typical net calorific value (NCV) ranging from 10 – 20 MJ/Nm$^{3}$.

7.60 Gasification is the partial combustion of materials through the inclusion of oxygen/air at higher temperatures than used for Pyrolysis, (generally between 1000 – 1200$^{o}$C). The addition of water to the gasifier, as either steam or as water at the higher temperatures, causes the water to 'crack' into its component parts of hydrogen and oxygen. The oxygen produced reacts further with the carbon within the MSW. There is a high concentration of hydrogen produced in this process, and the Syngas produced can be combusted to generate electricity; it has a typical net calorific value (NCV) ranging from 4 – 10 MJ/Nm$^{3}$.

7.61 A list of gasification and pyrolysis plants operating around the world for the treatment of municipal waste are presented in Appendix 7b.

**Table 7.10 Benefits and Constraints of Gasification and Pyrolysis**

| *Benefits* | *Constraints* |
|---|---|
| • May have higher power conversion efficiency and lower energy use than mass burn incineration. This could be more desirable in respect of EU intention to introduce efficiency thresholds to determine recovery from EfW.<br>• UK energy policy indicates support for development of ATT for treatment of MSW.<br>• Can result in a fuel product (char) which requires outlet (e.g. as substitute aggregate material) however char has no biodegradable content and could be landfilled without affecting landfill diversion targets.<br>• Technologies eligible for ROCs and also potential for funding under the and New technology Demonstrator Scheme | • Unproven to date in UK for treating MSW.<br>• Only non fossil fuel derived energy is eligible for ROCs and this leads to uncertainty/limitations to ATT of mixed waste securing ROCs. |

## DISPOSAL METHODS

### Landfill

7.62 Landfill is the emplacement of waste in designated areas of land, often disused quarries or similar voids. Landfill is a proven disposal method and modern landfills are engineered to high standards, using lining and landfill gas and leachate control systems in line with best practice across Europe. Although the preferred scenario maximises management options that are higher up the waste hierarchy, waste still remains that can not be processed in any other way, and landfill provides a disposal outlet.

7.63 New landfill sites in the arc21 Region are being developed to high environmental standards in accordance with the PPC regulations detailed in Chapter 2. It is anticipated that costs of landfill will continue to increase in the future as the full impact of legislation (Landfill Directive, PPC) and reduced availability of landfill takes effect.

7.64 Future landfills will be developed to high environmental standards and all landfills will be operated in accordance with new licensing conditions to be implemented under the Waste and Contaminated Land (Northern Ireland) Order 1997 and the IPPC Directive (see Chapter 2). In the future, much of the waste will have to undergo pre-processing prior to disposal to reduce its potential threat to the environment.

7.65 Until the mid-1990s, disposal to landfill was the most cost effective way of disposing of waste. However current costs are expected to continue to increase to meet the stringent requirements of the EU Landfill Directive, and further increases in the landfill tax. However energy produced from utilising harnessed landfill gas contributes to sustainability and can also increase the value of landfill sites.

## OPPORTUNITIES FOR AND CONSTRAINTS TO RECYCLING AND RECOVERY

7.66 Opportunities and constraints to the recycling material in the waste stream can be summarised in the following five categories:

- Costs – derived through collection, transportation, sorting and processing of waste materials
- Availability of facilities and technologies
- Contracts and markets – materials for recycling depend on the availability of secure markets and contracts. Experience from other parts of the world has shown that markets strengthen once the industry gains confidence that it will be supplied with regular flows of high quality materials. There have been a number

of recent developments that have opened up some of the most difficult markets. The current availability of market outlets for key materials is outlined below.

- Markets for recovery outputs – a level of uncertainty exists regarding the status of materials recovered from residual waste treatment processes. There are a number of key issues (discussed below) that will impact on the likely market interest for these materials
- Education and awareness – this is essential to assist in the cultural change in behaviour towards how we manage waste, and also to encourage waste minimisation.

7.67 In particular, the development of new markets for recyclable materials is recognised as essential to supporting increased recycling and resource recovery in NI. As a result the DOE established a market development programme to stimulate markets and make progress towards the targets set out in the NI Waste Strategy. The focus of this programme included: initiating projects through membership of WRAP, the establishment of a Waste Management Industry Fund, and establishment of a North South Market Development Steering Group with the Republic of Ireland. From 2005, the focus of market development will comprise

- **Waste Resources Action Programme (WRAP)** – WRAP is a not for profit organisation which has been set up to create stable and efficient markets for recycled materials and products. It receives funding from central government and the devolved administrations, and is at the forefront of market development across the UK. The DOE intends to participate fully in WRAP market development initiatives, including the organics market development programme, new materials programme and extended business development service.

- **Recycling and Organics Technical Advisory Team (ROTATE) –** ROTATE was started in 2004 as an addition to WRAP's existing programme of work. ROTATE provides free, independent advice to local authorities on implementing kerbside collection programmes, and education and awareness schemes. This includes advice on end market issues.

- **Market Development Forum** – This proposed forum will focus on the key issues influencing market development in Northern Ireland.

- **Awareness and Information** –the Government's public awareness and education campaign includes a number of actions in support of market development initiatives. These include developing business pages as part of the *Wake Up to Waste* campaign and EHS websites to provide dedicated information and advice to businesses in developing appropriate market development schemes.

### Organics

7.68 Organics include all items that can be composted (aerobically) or digested (anaerobically) such as kitchen and garden waste. Many of the arc21 councils have introduced green waste composting in the recent past and there is potential to expand the current green waste recycling capacity, with a number of contractors willing to invest if given guaranteed contracts.

7.69 Sites for composting are well suited to active or former landfill sites where the facilities are in place for leachate and landfill gas control, and there is an established transport network for waste transfer. Given the importance of agriculture in Northern Ireland there are opportunities to develop on-farm composting of green waste with the product generated being used on-site.

7.70 Static pile/forced aeration composting is popular with local contractors due to lower capital costs, and ease of access to the technology. However, the biological treatment of a wider range of organic wastes favours some form of enclosed composting or digestion.

7.71 There are currently an expanding number of green waste re-processors in Northern Ireland who are actively developing the collection of green wastes, and the facilities and markets for the product. The home market for bagged and bulk compost is increasing due to trends in conservation of peat land areas in Ireland and development of intensive market gardening.

7.72 Bulkier garden waste and agricultural/timber waste has clear potential to be used as an industrial woodchip. There is a strong demand for fibreboard and particleboard for flooring and construction purposes in Ireland. The manufacturing requirement cannot be met from naturally sustainable resources. There is clearly an opportunity for wood based chips to make up this shortfall. Site constraints are not quite so marked for this product as mobile grinders are available, although contamination of the raw material can be a constraint.

### Glass

7.73 Glass reprocessing is established in Ireland with one major manufacturing plant located in Northern Ireland. In the arc21 area, all 11 District Councils use Glassdon Waste who collect and clean glass cullet on their behalf.

7.74 The demand for clear flint cullet is currently high but markets for brown and green glass will need to be developed. Other than producing new glass products, recycled glass can be used for abrasives, as a road aggregate or as a filtration media. The potential for premises to further enhance segregation will be realised by further competition in the market place leading to better services by contractors.

### Paper

7.75 The range of products for recycled paper is fairly diverse and the ability to sort mixed grades will improve levels of paper recycling.

7.76 Regular fluctuations in the paper market affects the viability of recycling, but paper markets in Northern Ireland currently appears to be quite strong. Bryson House (Mallusk) recycle a number of materials including paper, some of which is sent to Shotton Paper Mill in England. Huhtamaki Ltd (Lisburn) (formerly Lurgan Fibre) undertake sorting, shredding and baling of waste paper. They are currently working to capacity, processing 16,000 tonnes of newspaper and magazines per year for conversion into egg boxes. There is also good global demand and capacity for processing paper in the UK mills. Two of the arc21 councils operate a separate kerbside paper collection for exporting newspapers and magazines to Cheshire Recycling through Kosmos Recycling. There are other companies who are also sorting paper throughout Northern Ireland and making use of both UK mills and Far East markets. These companies are collecting all grades of paper and cardboard and service a variety of commercial waste customers. They provide security shredding as an added value service and on request will segregate materials at client premises.

### Metals

7.77 The main processor of metal waste in Northern Ireland is Clearway who handle ferrous and non-ferrous metal products, separating out different components and shipping them to the continent and Great Britain to be made into new products. The aluminium cans market is regarded as steady and there is capacity to handle increased levels both by Clearway and at Alcan's plant in Warrington, England. Used cans are processed back into aluminium cans with no loss of material quality. Aluminium foils and cans when mixed with other aluminium scrap can be recycled by Alcan and other smelters elsewhere in the UK and overseas, in open loop recycling systems. The industry has in place sufficient reprocessing capacity to recycle all the aluminium packaging and drinks cans placed on the UK market. Clearway is the major exporter of metal but there are smaller players emerging in the market. Bryson House operate a widespread cash for cans campaign aimed primarily at householders, while Clearway's current focus is on the commercial waste stream. There are also a number of additional localised metal re-processors who have capacity to process metals wastes; T Met Ltd, Thomas Hamill & Sons and O'Kane Metals Ltd who sort and store scrap metals. Avenue Recycling and Glassdon also operate similar metal can schemes to Bryson House.

### Textiles

7.78 Recycled textiles can be used to make new yarn, or for the manufacture of furnishings, blankets, industrial wipes, or for filling for upholstery and bedding. There

is a well-established textiles market in Northern Ireland where textiles are graded and sold to various destinations depending on material type and use. The industry is currently undergoing difficulties and prices for materials have dropped. Although they may continue to fall, it will probably remain a stable outlet. Using established and emerging sorting and processing contractors, arc21 will be able to secure markets for textiles. Alternatively bulk re-use of textiles is possible by offering clothes to charity shops by formal agreement. The Salvation Army and Cookstown Textile Recovery operate widely in the arc21 Region.

### Plastics

7.79 The success of plastic recycling in Northern Ireland depends on the ability to identify, separate and then process different types of plastics. At the moment, the majority of plastic recycling companies can only handle single polymer materials, and therefore are only suited to commercial and industrial waste streams.

7.80 Some plastic collectors are able to accept loads of mixed plastics which they sort and export for reprocessing for no payment. A number of these contractors intend to develop processes to recycle on site. At least one contractor is providing bring banks for household waste plastics in the arc21 Region, but the tonnage handled through this route is currently very small. Bryson House collect, bale and store plastic bottles for reprocessing through the MRF at Mallusk. Irish Polymers sort, bale and shred plastic wastes.

### Computer/Electrical

7.81 The majority of materials and components used in the manufacture of most computers and electrical appliances could potentially be re-used. There is a growing refurbishment sector that repairs and upgrades existing computers. Normally these computers are passed on to schools, charities and voluntary groups. There are also a significant number of companies involved in the re-manufacture of printer cartridges.

7.82 Most establishments do not produce bulk quantities of this type of waste at any one time so the costs associated with collection of “one-off” wastes restricts the amount collected for refurbishment. Co-operation between producers and between collectors would serve to minimise this constraint and this can be expected to develop further in the future with the introduction of the EU Waste Electrical and Electronic Equipment (WEEE) Directive. Printer cartridges are collected by a number of charities for re-processing.

### Construction, Demolition and Extraction (C, D & E)

7.83 The building industry is one of the most significant producers of waste. Construction, demolition and extraction (C, D & E) waste can be re-used with little or no treatment,

and small scale recycling of C, D & E waste is being increasingly adopted by many building/civil contractors. Evidence from reviews of major contracts in the arc21 Region, such as the redevelopment of the Belfast flyover, the Odyssey project and more recently the Sirocco works demolition, suggest that the building industry is already recognising and implementing better practice in relation to re-use of construction wastes. Independent contractors are also entering the market to further screen materials that can be reprocessed at locations other than on-site. For example, timber is removed from general rubble and chipped for recycling or recovery elsewhere. The major regeneration scheduled for the Titanic Quarter of the Belfast Waterfront will provide further opportunity for the building industry implement these better practices on a large scale redevelopment project over an extended period of time.

7.84 Major primary mineral processors such as Tarmac, ARC and Maxwells already are, or are planning to, reprocess construction wastes for use as aggregates and at £1.60/t. The Aggregate Tax will further incentivise this practice.

### Hazardous

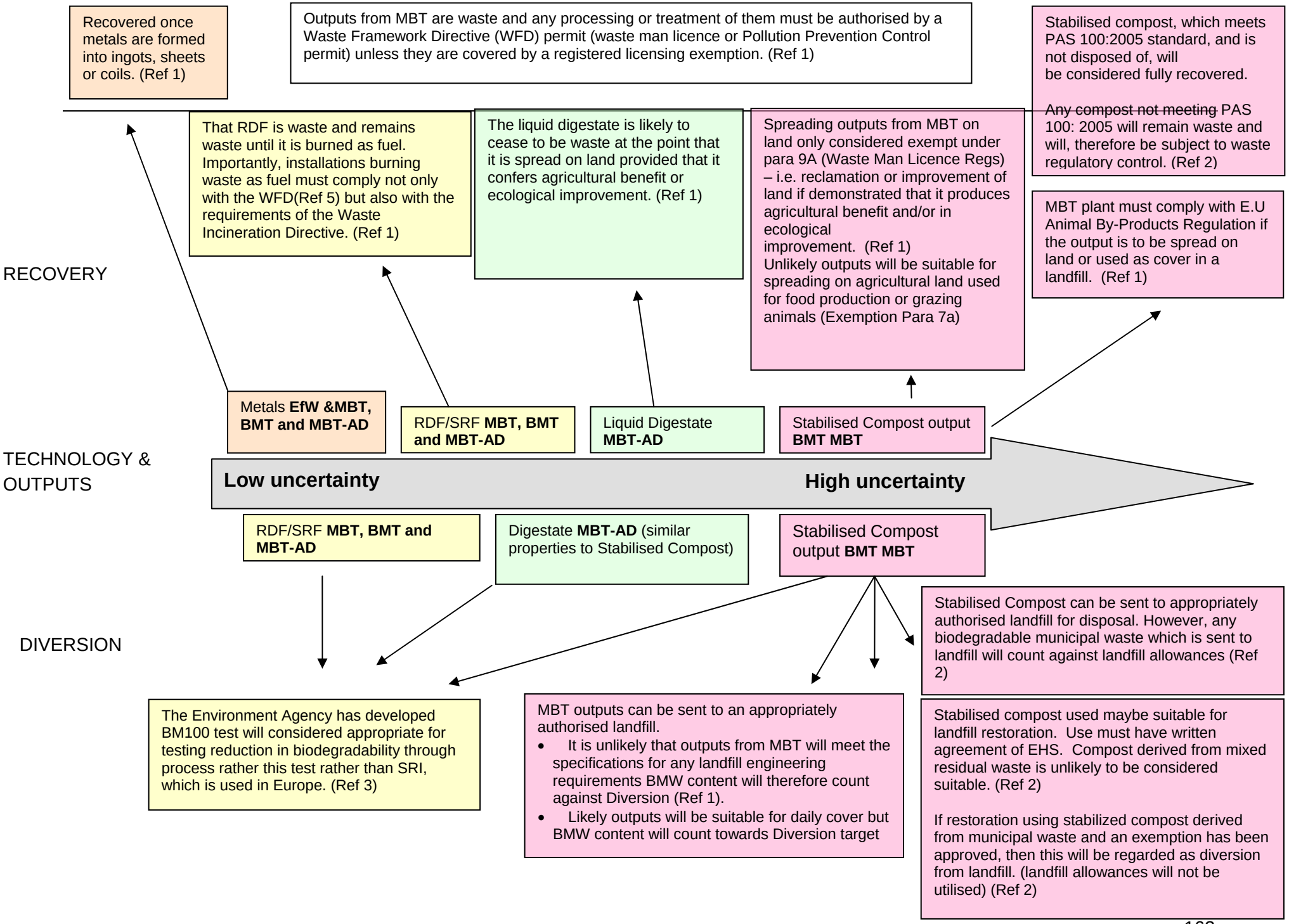
7.85 Hazardous wastes such as batteries and fluorescent tubes are exported after collection and primary preparation, and there is an established network of organisations performing this service. Possible changes in market factors may not allow for continued export and could restrict the future recycling of these products in Northern Ireland. There are a number of companies located throughout the arc21 Region and further afield who are able to handle a wide suite of hazardous waste arisings.

### Residual Waste Treatment Outputs

7.86 A number of output materials are produced by the treatment technologies considered in this Chapter and these comprise recyclables (metals, plastics), a refuse derived fuel /solid recovered fuel element, an organic stabilised compost-like material and a solid digestate material from anaerobic digestion.

7.87 As there are none of the illustrated plants currently treating municipal wastes in Northern Ireland, the market for these output materials is uncertain. Although potential markets for these materials exists in Northern Ireland, there are a number of legislative and policy drivers that may affect market development. These are summarised in Figure 7.4.

**Figure 7.4: Summary of Market Uncertainty for outputs from Residual Waste Treatment Processes**


Recovered once metals are formed into ingots, sheets or coils. (Ref 1)
Outputs from MBT are waste and any processing or treatment of them must be authorised by a Waste Framework Directive (WFD) permit (waste man licence or Pollution Prevention Control permit) unless they are covered by a registered licensing exemption. (Ref 1)
Stabilised compost, which meets PAS 100:2005 standard, and is not disposed of, will be considered fully recovered.
~~Any compost not meeting~~ PAS 100: 2005 will remain waste and will, therefore be subject to waste regulatory control. (Ref 2)
That RDF is waste and remains waste until it is burned as fuel. Importantly, installations burning waste as fuel must comply not only with the WFD(Ref 5) but also with the requirements of the Waste Incineration Directive. (Ref 1)
The liquid digestate is likely to cease to be waste at the point that it is spread on land provided that it confers agricultural benefit or ecological improvement. (Ref 1)
Spreading outputs from MBT on land only considered exempt under para 9A (Waste Man Licence Regs) – i.e. reclamation or improvement of land if demonstrated that it produces agricultural benefit and/or in ecological improvement. (Ref 1)
Unlikely outputs will be suitable for spreading on agricultural land used for food production or grazing animals (Exemption Para 7a)
MBT plant must comply with E.U Animal By-Products Regulation if the output is to be spread on land or used as cover in a landfill. (Ref 1)
RECOVERY
Metals **EfW &MBT, BMT and MBT-AD**
RDF/SRF **MBT, BMT and MBT-AD**
Liquid Digestate **MBT-AD**
Stabilised Compost output **BMT MBT**
TECHNOLOGY & OUTPUTS
Low uncertainty
High uncertainty
RDF/SRF **MBT, BMT and MBT-AD**
Digestate **MBT-AD** (similar properties to Stabilised Compost)
Stabilised Compost output **BMT MBT**
DIVERSION
Stabilised Compost can be sent to appropriately authorised landfill for disposal. However, any biodegradable municipal waste which is sent to landfill will count against landfill allowances (Ref 2)
The Environment Agency has developed BM100 test will considered appropriate for testing reduction in biodegradability through process rather this test rather than SRI, which is used in Europe. (Ref 3)
MBT outputs can be sent to an appropriately authorised landfill.
• It is unlikely that outputs from MBT will meet the specifications for any landfill engineering requirements BMW content will therefore count against Diversion (Ref 1).
• Likely outputs will be suitable for daily cover but BMW content will count towards Diversion target
Stabilised compost used maybe suitable for landfill restoration. Use must have written agreement of EHS. Compost derived from mixed residual waste is unlikely to be considered suitable. (Ref 2)
If restoration using stabilized compost derived from municipal waste and an exemption has been approved, then this will be regarded as diversion from landfill. (landfill allowances will not be utilised) (Ref 2)

References For Figure 7.4
1 – EA Guidance - The Mechanical Biological Treatment of Waste and regulation of the outputs Version 1 June 2005
2 - EHS Waste Management and Contaminated Land, Composting Guidance Sept 2005
3 - Estimating biodegradable municipal solid waste diversion from landfill: Monitoring biodegradable municipal waste removal in a Mechanical Biological Treatment process R&D Technical Report P1 - 513 (EP 0173) November 2004
4 – NI Animal Bi-product regulations 2003

7.88 Generally, guidance on interpretation of recovery for the inorganic elements separated from residual waste treatment technologies (e.g. metals, glass etc) is relatively straightforward. It should therefore be possible to secure markets for these materials.

7.89 There is more uncertainty over the interpretation of recovery for the organic elements separated through the MBT processes; overall these materials are expected to be subject to the findings of research undertaken by the Environment Agency on the calculation of biodegradability reduction. It should be possible to demonstrate that the refuse derived fuel element of the MBT processes is recovered, provided it is burned as a fuel in an appropriately licensed facility. The refuse derived fuel will remain a waste and therefore facilities required for this material will need to be Waste Incineration Directive compliant. This is expected to preclude the use of RDF in Power Stations which would require significant upgrading to comply with the Directive. Existing facilities considered appropriate for RDF are Cement Kilns. There are only two such facilities (located in Co Tyrone and Co Fermanagh) and it is unlikely that this will be able to offer a long term market to address the needs of Northern Ireland. Alternatively, a solution to the market for RDF is to develop energy from waste capacity. This has the advantage of providing a secure long term market for the RDF and also a facility operated at the high standards required by the Waste Incineration Directive.

7.90 Most uncertainty surrounds the interpretation of recovery for stabilised compost materials from the MBT processes. Under the Environment Agency guidance (reference 1 and 3 in Figure 7.4), all waste streams from MBT should be evaluated for biodegredable content using the DR4 and BM100 tests. These tests assess the organic biodegredable content and the landfill gas potential of the wastes. These tests are considered to be more comprehensive than the AT4 (Static Respiratory Index) test commonly used in Europe. They also take longer to complete than the AT4. The likely impact is that these tests will indicate a lower biodegradability reduction than has been reported in Europe because of the increased test length and the higher test temperatures used. This will not be finalised however until specific MBT plants have operated for 12 months or more and have been subjected to monitoring using the EA tests. Unless these issues can be clarified, it is unlikely that reliable and sustainable markets will be found for these materials.

### Summary of Opportunities and Constraints

7.91 Green waste reprocessing has been established in Northern Ireland over the past few years. arc21 councils have introduced green waste composting and there is potential for further expansion. With the introduction of the arc21 organic waste treatment

contract, it is expected that organic waste reprocessing capacity will be stimulated within Northern Ireland. As there is currently strong demand for fibreboard and particle board for flooring and construction purposes in Ireland there is also potential for bulkier garden waste and agricultural/timber waste to be used as an industrial woodchip. The demand for reprocessing of clear flint glass cullet is high, although markets need to be developed for brown and green glass. There is currently diversity in the range of recycled paper products available. However improved sorting of mixed grades will improve levels of paper recycling, although fluctuations in the market can affect the viability of paper recycling. Currently paper markets in Northern Ireland are quite strong.

7.92 There is one major commercially focused metal exporter in Northern Ireland with a number of other smaller players emerging. There is a steady market for aluminium cans which can be reprocessed with no loss of quality. The textile market is well established, although the textile industry is currently undergoing some difficulties. There are secure markets for textiles and also opportunities to offer clothes to charity outlets. Currently, most plastic recycling companies can only deal with single polymer materials suited to commercial and industrial waste streams. Future opportunities in plastics recycling will depend on the ability to identify, separate and process the different types of plastics in the waste stream. There is currently some small scale recycling of household plastics, via bring banks, in the arc21 Region.

7.93 Recycling markets for computer and electrical equipment are constrained by the small size of collections and associated costs. Typically this type of waste is in the form of 'one-off' arisings and most establishments do not produce bulk quantities on a regular basis. The construction and demolition sector is experiencing a growing trend in reusing construction wastes. The Aggregate Tax will add further incentive for the reprocessing of construction wastes. Possible changes in market factors may disallow the export of hazardous wastes such as batteries and fluorescent lights. If operational barriers to cross border shipments are removed, there is the potential for sorting and reprocessing these wastes in the Republic of Ireland.

7.94 Markets for organic outputs from residual waste treatment (e.g. refuse derived fuels and stabilised compost materials) are not certain. Clarification of the interpretation of recovery for these materials will benefit market development.

7.95 Increases in the range and scale of materials that can be recycled will provide opportunities for economic development and employment.

## CONCLUSIONS

7.96 There are a significant number of local reprocessors and waste collectors in Northern Ireland who can provide the basis of a sustainable recycling and recovery industry. Rationalisation of existing contract arrangements and segregation of the feedstocks

they require are key precursors to expanding this capacity and stimulating economic recycling.

7.97 The degree to which the recycling of the waste materials outlined will be successful will largely depend on stable market outlets and a steady supply of materials. Initiatives are now being co-ordinated at a national level to promote the development of new markets for recyclate. Of major importance is the education of all those responsible for waste production from private householders to large multinational organisations and increased awareness of the issues facing waste management and disposal.