Material change for
a better environment

Market Situation Report – April 2008

Realising the value of organic waste

Welcome to the Organic Waste Market Situation Report, the fourth in our series of reports that examine current economic conditions in the recovered materials markets.

This report looks at the key factors influencing the market for organic waste over the past year or so; movements in prices; and the environmental benefits from dealing with organic waste sustainably.

In addition, the special report investigates the issues around the growth in food waste processing.

Key themes to emerge from the organic waste sector in the last year are:

- kerbside collections accounted for the majority of organic material recovered from the municipal waste stream for the first time;
- food waste collections have grown rapidly, and are expected to continue to do so as higher landfill tax rates make alternative disposal routes for food waste look more financially attractive; and
- prices for compost products have been stable, but historically high prices for chemical fertilisers and soil improvers could support compost prices going forward.

Did you know?

20% **The average annual growth in the amount of organic waste composted over the past 5 years.**

300kWh **The amount of energy that can be generated by anaerobically digesting one tonne of food waste.**

£ **Typical prices for loose composts:**

£3 per m^3
for 0-40 mm grade

£12 per m^3
for 0-5mm grade

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Organic waste arisings and management in the UK

Annual organic waste arisings are estimated to be around 25 million tonnes, broadly evenly split between food wastes and garden wastes (Table 1). Around half of this total comes from the municipal waste stream.

Forecasts for 2006/07 suggest that over 4 million tonnes of source segregated waste were composted (Graph 1), with 3.6 million tonnes (90%) of this sourced from the municipal waste stream. The overall total represents an increase of more than 20 per cent from 2005/06, and is quadruple the level of 2000.

The vast majority of organic material recovered for composting is garden waste (Table 2/Graph 2). This reflects the rapid increase in garden waste kerbside collections offered by local authorities over the last three years. In England, for example, this has increased from less than 75 per cent of authorities in 2004/05, to almost 95 per cent in 2006/07 (Table 3).

As a result, 2006/07 marked the first time that kerbside collections accounted for the majority of recovered organic material in the UK. However, as the capture rate for garden waste is over 50 per cent, it is likely that growth in garden waste collections will slow over the next few years.

By contrast, food waste collections (either separate or mixed with garden waste) are likely to continue to grow rapidly, as local authorities look to target what is the largest remaining fraction of the residual waste stream.

About 250,000 tonnes of food waste were recovered for processing in 2006/07. The number of local authorities offering or trialling food waste collections has increased sharply, albeit from a small base. A special topic later in this report analyses the challenges associated with food waste processing.

In addition, about one third of UK households with gardens currently compost at home. It is estimated that home composting diverts more than 500,000 tonnes per annum of garden and kitchen waste from the municipal waste stream, thereby avoiding the costs of waste collection and disposal. Home composting does not, at present, contribute towards the landfill diversion targets, although it is likely to in the future.

Data from surveys of composting companies suggest that only around 500,000 tonnes per annum (less than 5 per cent) of commercial and industrial (C&I) organic wastes are currently composted. However, other data sources suggest that only about one quarter of C&I organic wastes go to landfill, with recycling, reuse or recovery accounting for the vast majority of the remainder. Some of the recycling is likely to be composting or anaerobic digestion (AD) at on-site facilities, which fall outside the coverage of this report.

Manures and slurries arising from agricultural activities (approx. 90 million tonnes per annum) are not classified as waste when spread on land as a fertiliser for the benefit of agriculture and hence are out of the scope of this report. Sewage sludges (around 2 million tonnes per annum) are also not considered within this report.

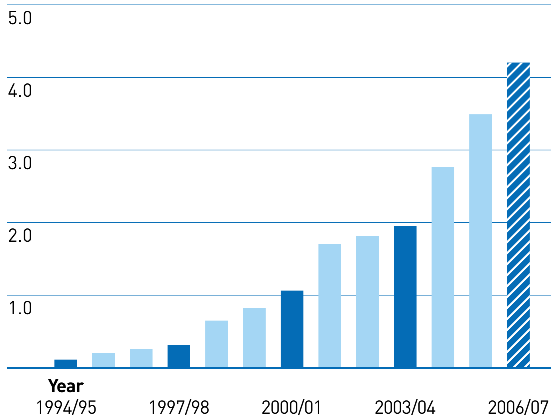
Table 1: UK organic waste arisings by sector
million tonnes

	Municipal	Commercial and industrial	Total
Kitchen/food	6.1	5.7	11.8
Garden	6.4	4.2	10.6
Other	0	2.6	2.6
Total	**12.5**	**12.5**	**25**

Note: More recent data suggest that the food waste fraction of municipal waste may be as high as 6.7 million tonnes, but this may be offset by a smaller garden waste component.

Source: ERM (2006) based on data for 2003/04.

Graph 1: Composting of source segregated waste
million tonnes (input)



Sources: The Composting Association (TCA) and WRAP forecast for 2006/07.

Table 2: Municipal collections of organic waste, 2006/07
thousand tonnes

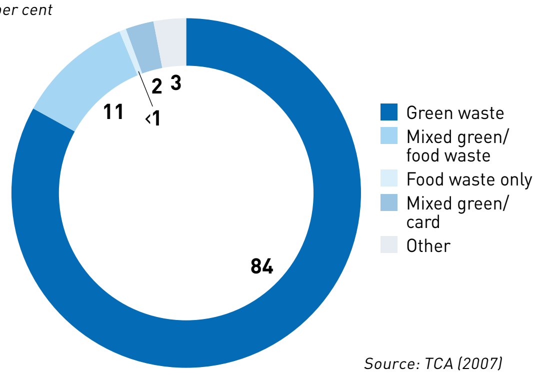
	Kerbside	Of which reported as 'green waste only'[1]	Bring/civic amenity sites	Other[2]	Total
England	1,749	1,374	1,143	114	3,007
Wales	63	58	62	47	172
Scotland	187	177	69	72	327
Northern Ireland	49	37	57	0.5	106
Total	**2,048**	**1,645**	**1,331**	**233**	**3,612**

[1] *There may be other collections of green waste (such as of Christmas trees) not included within these data.*

[2] *'Other' includes municipal collections of commercial and industrial waste, voluntary kerbside and bring site, and municipal parks/grounds waste.*

Source: WasteDataFlow.

Graph 2: Composition of municipal organic waste collected for composting, 2005/06
per cent



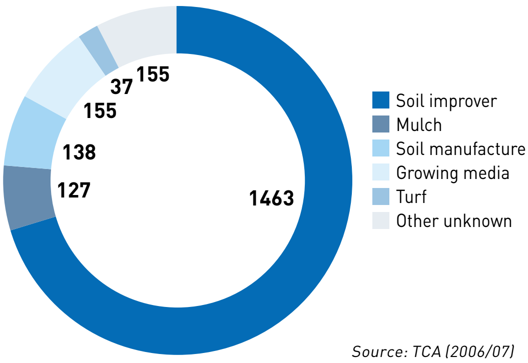
Source: TCA (2007)

Table 3: Collection trends in England: number of local authorities operating kerbside organic waste collection schemes in England

	2004/05	2006/07
Garden waste collection	**255**	**332**
Garden waste only	198	255
Garden and card	27	42
Garden and food	9	20
Garden, card and food	14	20
Unknown	7	0
No garden waste collection	**99**	**22**
Separate food waste collection	**9**	**42**

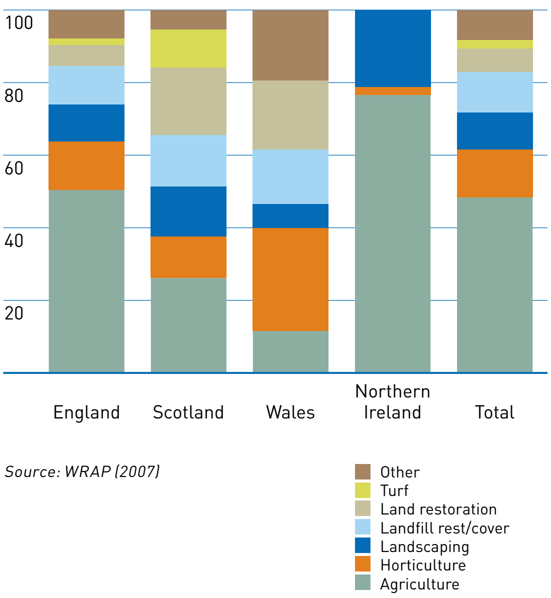
Note: There are 354 collection authorities in England. Not all schemes cover all households. Numbers do not sum to total as some LAs operate multiple schemes. Both established and trial schemes have been included. Source: WRAP.

Graph 3: Compost products manufactured, 2005/06 thousand tonnes



Source: TCA (2006/07)

Graph 4: Geographical variation in the markets for composting products
per cent



Source: WRAP (2007)

The UK composting industry

The UK composting industry – covering production (but not blending), distribution and sales of compost – was estimated to have a turnover of around £90 million in 2005/06. Two-fifths of companies operating within the sector are believed to be specialist composting companies, with waste management companies and agricultural companies each accounting for a further fifth. The industry employs around 1,200 full time equivalent employees. The box on page 8 provides further information about the key methods of processing organic wastes.

The composting sector is expected to continue to grow rapidly over the next few years. Scenario analysis undertaken by WRAP suggests that, in order to meet the targets under the EU Landfill Directive, 5 million tonnes of municipal organic waste will need to be composted by 2012/13, over 1 million tonnes of which will be food waste. Compost producers are aware of the need to respond to this increase in demand and have indicated that – subject to the right economic conditions – they could add around 2 million tonnes of new capacity over the next five years.[1]

End markets for composts

Around 70 per cent of the compost products manufactured are soil improvers (0-25 mm for composts, or 0-40 mm for agricultural applications, Graph 3). This share appears to have grown over the past five years, although there has been growth in absolute terms in other products. Coarser grade (25-40 mm) composts can be used as mulches, while finer grade composts (0-5 mm) can be used as top dressings. Compost, when mixed with subsoil or other mineral materials, can also be used to manufacture top soils.

Organic wastes and manufactured composts are bulky, so transport and distribution costs limit the distances over which it is feasible to move both feedstock and final products. Compost products have a relatively low value compared with other recovered materials and margins for businesses operating in the industry are tight. As a result, treatment facilities tend to be located close to feedstock supplies, the end-markets tend to be local, and the products and end users vary by region. Products targeted at sectors such as horticulture, landscaping and sports turf do offer higher values, which is reflected in increased regional and national distribution of these products.

Across the UK as a whole, almost half of the compost manufactured from source segregated waste is used in agriculture (Graph 4), mostly in arable and cereal crops farming. But within regions, the proportion used in agriculture ranges from less than 10 per cent in Wales to almost 80 per cent in Northern Ireland and Yorkshire and Humber. This variation reflects not only the prevalence of agriculture within a region but also the availability of animal manure alternatives.

Horticulture is the next largest end market, accounting for about 13 per cent across the UK. Within this, the amateur growing market is roughly double the size of the professional horticultural market. Here too there is a wide regional variation, with horticulture accounting for 30 per cent or more of the end markets in Wales and the North West but very little in other areas.

[1] *Source: TCA survey (2007).*

Other major end markets include landscaping (about 10 per cent), land regeneration (7 per cent) and turf applications (eg for racecourses and golf courses, about 2 per cent). Nearly half of the almost 100,000 tonnes of compost used in regeneration projects in 2005/06 were used in London.

Agriculture, landscaping and land restoration offer the greatest potential for market growth in the composting sector. Although the agriculture sector is by far the largest end user of organic composts, the sector remains an intensive user of mineral fertilisers – some of which could be at least partially replaced by composts. Recent WRAP research[2] suggests that agricultural demand for compost could grow by a further 2 million tonnes, while the horticultural market offers potential growth of 600,000 tonnes. In addition, landscaping and regeneration activities may offer a further 260,000 tonnes and 60,000 tonnes respectively.

Prices

Gate fees

Local authorities and waste management companies pay disposal charges or 'gate fees' for treatment of organic waste at composting facilities. Gate fees for windrow composting are broadly similar to those payable for landfill. But because no landfill tax is incurred, composting garden waste is substantially cheaper than disposing of it via landfill (Graph 5), notwithstanding the higher costs associated with segregated collections. Over the past five years, garden waste gate fees have risen faster than the rate of inflation. However, landfill costs have increased at a faster pace still, primarily because of the escalator on landfill tax.

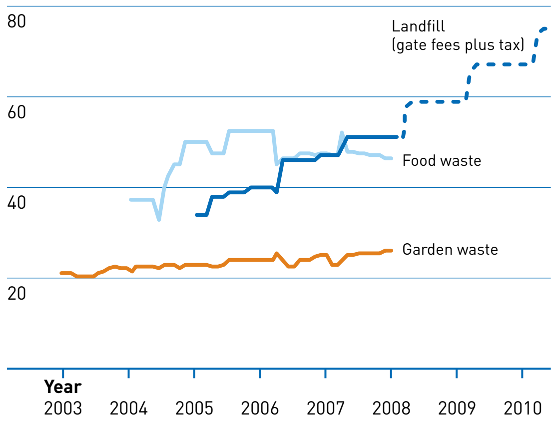
Gate fees for food waste (or mixed food and garden waste) are higher than those for garden waste because of the higher capital and operating costs associated with in-vessel composting (IVC) and anaerobic digestion (AD) facilities. While landfill disposal costs are broadly in line with gate fees for food waste processing facilities, the rising cost of landfill will mean that food waste processing will become an increasingly attractive option (Graph 5). For more on food waste processing and anaerobic digestion please read the special report on page 9.

Compost product and compost substitutes

Around 2 million tonnes of compost were commercially produced in 2005/06. Of this, approximately half was sold to end users, a third was used on the site of production and the remainder was distributed free of charge. Despite the rapid growth in the production of compost over the past five years, these proportions do not appear to have significantly changed.

Graph 5: Organic waste gate fees

£ per tonne



Sources: LetsRecycle.com and MRW.
Forecast for landfill incorporates changes in landfill tax only.

Across the UK as a whole, almost half of the compost manufactured from source segregated waste is used in agriculture.

[2] *Source: WRAP (2007), 'Regional compost markets assessment: Phase 2', report by Enviros Consulting and ADAS.*

Quality Protocols and Standards for organic materials

The 'Quality Protocol for the production and use of quality compost from source-segregated biodegradable waste' (QP) was published in March 2007. It sets out the criteria for the production of quality compost from source segregated biodegradable waste (biowaste) and is applicable in England and Wales.

Compliance with the QP is considered sufficient to ensure that the product may be used without risk to human health or the environment, and therefore without the need for waste regulatory control.

The QP aims to reduce the regulatory burden associated with producing and using quality compost. This should make it easier for compost producers to market and tap into the demand for their product because it is then classified as a commodity in its own right rather than waste.

In order to comply with the QP, the compost must be produced to the British Standards Institution publicly available specification for composted materials (PAS 100). By January 2008, over 150 producers – producing a total of almost 1.5 million tonnes of compost – were certified, or in the process of being certified, to the scheme.

Work on a Quality Protocol for anaerobic digestate is expected to be launched for consultation in April 2008. WRAP also worked with the British Standards Institution to redraft the specification for topsoil (BS3882) to facilitate the uptake of composts in manufactured soils.

On the one hand, this is encouraging evidence that the markets for higher value composting products have grown in line with the rapid growth in composting, but on the other it points to an ongoing reliance on gate fees and a continued perception that compost has little or no value.

For those products that are sold, prices vary according to the grade of compost. Ex-works prices for loose compost typically range from around £3 per m^3 for 0-40 mm grade composts to £12 per m^3 for finely graded (0-5mm) composts. The average bulk density of compost is around 500kg/m^3, which implies a price range of £6 to over £20 per tonne.

The evidence on trends in compost prices is mixed. Some data sources suggest that prices have risen over the past three years, while others suggest falling prices. Both the demand for and supply of compost appear to have grown, but it is not clear which of these effects is dominating. On the one hand, the supply of compost from source segregated wastes has increased dramatically over the past few years, possibly putting downward pressure on prices. On the other, demand for organic composts is also growing, in part reflecting the increased retail demand for organic food and peat-free composts.[3]

The value of compost as a replacement for inorganic fertiliser is estimated to be around £5 per tonne, although this is offset by the costs of spreading, which are in the order of £1-£3 per tonne. However, prices of chemical-based fertilisers have risen sharply in recent months, which could lead to a further increase in agricultural demand for organic fertilisers. Prices for chemical fertilisers and soil improvers rose by almost 50 per cent in the second half of 2007 and are at historically high levels. This increase has been driven in part by the increase in the prices of natural gas – the main feedstock for ammonia-based fertilisers – but it also reflects strong world demand for fertilisers. Although new ammonia capacity is expected to become operational in the year ahead, prices are expected to remain strong. Against this backdrop, higher usage of compost in agricultural applications as an alternative source of nitrogen has the potential to offer cost savings.

Did you know?

2m Around 2 million tonnes of compost were commercially produced in 2005/06.

50% Prices for chemical fertilisers and soil improvers rose by almost 50 per cent in the second half of 2007.

£1,000 Bagged retail composts range in price from around £50 per tonne for multipurpose compost to over £1,000 per tonne for speciality blends.

Choose compost containing recycled material

recycle

[3] *Source: Horticultural Trades Association Garden Industry Monitor.*

Topsoil prices vary according to the end market, specification and the volume required, but typical delivered price ranges are £11-£18 per tonne for the landscaping sector and £15-£30 per tonne for sports and leisure applications.

The retail market for composting products is highly differentiated into dozens of niche products, but bagged retail composts range in price from around £50 per tonne for multipurpose compost to over £1,000 per tonne for speciality blends (although the market for and yield of these products is small).

Capital costs of composting

Recent data suggest that capital costs for windrow average about £35 per tonne of annual capacity (Graph 6), although there is a wide variation around this. Because of the greater degree of control required, food waste processing capacity is significantly more capital intensive than garden waste capacity. The average cost of IVC facilities is around £90 per annual tonne, while indicative costs for AD facilities are in the region of £150-£300 per annual tonne.

There appear to be substantial economies of scale in the capital costs of composting facilities; more so for IVC than for windrow. These economies of scale arise largely because of the fixed infrastructure costs associated with putting new sites in place. Larger facilities enable these costs to be spread across higher tonnages. However, set against these possible savings are increases in transport costs – for both feedstocks and products – if the catchment area is widened to collect greater volumes.

Possibly reflecting this trade-off between economies of scale and transport distances, two fifths of commercial composting facilities – who between them process three quarters of the UK's recovered organic waste – accept between 10,000 and 50,000 tonnes of input material per annum (Table 4).

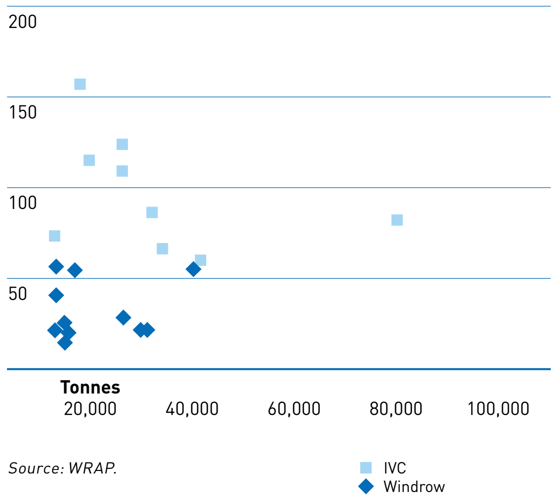
The environmental benefits of composting

When food and garden wastes decompose in landfill, they produce biogas, a mixture of CO_2 and methane, the latter being a substantially more potent greenhouse gas (GHG) than CO_2. Some of the biogas can be captured and used to generate heat or electricity. Nevertheless, landfill gas emissions from food and garden waste breakdown are estimated to account for about 20 per cent of the UK's methane emissions.[4]

When food and garden wastes are composted they produce water and CO_2. Some of the carbon is sequestered into the compost – and hence in the soil if the compost is applied to land – leading to a reduction in GHG emissions. Set against this, however, are increased transport and process emissions.

Graph 6: Economies of scale in composting facilities

Total funding costs, £ per annual tonne of capacity



Source: WRAP.

Table 4: Distribution of commercial composting facilities by size, 2005/06

Input tonnage *thousand tonnes*	Number of sites	Total input tonnage
<5	93	187
5-10	39	381
10-50	92	2,550
>50	4	305
Total	**228**	**3,424**

Source: TCA (2007).

Landfill gas emissions from food and garden waste breakdown are estimated to account for about 20 per cent of the UK's methane emissions.

[4] *Sources: Defra and WRAP estimates. See http://www.defra.gov.uk/environment/statistics/globatmos/gagccukem.htm.*

A conservative estimate suggests that UK composting of green waste reduced CO_2 equivalent emissions by more than 500,000 tonnes over the past year.

Nevertheless, each tonne of garden waste composted, rather than disposed of via landfill, and used in an agricultural application leads to a reduction of between 90kg and 230kg of CO_2 equivalent emissions.[5] Some applications (such as topsoil manufacture and growing media) appear to offer greater savings. Nevertheless, a conservative estimate suggests that UK composting of green waste reduced CO_2 equivalent emissions by more than 500,000 tonnes over the past year.

If food waste is processed in an AD facility, the decomposition is controlled and all of the biogas can be captured and used to generate heat and electricity.

Each tonne of food waste produces biogas sufficient to generate about 300kWh of electricity. When compared with disposal via landfill, each tonne of food waste processed via AD is estimated to save about one tonne of CO_2 equivalent emissions.

There may be further CO_2 benefits from using organic composts and digestates in place of mineral fertilisers, although these have not yet been quantified.

Composting has environmental benefits over and above its effects on greenhouse gas emissions. Compost is a valuable source of organic matter, and a source of slow-release nutrients, improving yields and cutting the need for traditional fertilisers.

[5] *The GHG benefits of various options for managing biodegradable wastes are the subject of a current Defra study. In the absence of definitive data, the figures cited are based on a range of sources.*

When food and garden wastes are composted they produce water and CO_2.

When used as a soil improver, it makes the soil less bulky, which can lead to an improved water holding capacity meaning that less irrigation is required, and it can also increase the ability of the soil to withstand extreme weather events. Soils manufactured from quality composts are free from weed seeds, which can cut the use of herbicide sprays and reduce post-planting maintenance. And using compost combined with on-site subsoils within regeneration projects reduces lorry movements and transport costs and also means that the soil matches the local environment and geological conditions. Compost may also have a role to play in the bioremediation of contaminated sites, although this is still under investigation.

The challenges facing the composting industry

The composting industry has expanded at a dramatic pace over the past ten years, but this growth has been predominantly in garden waste (open air windrow) composting. It is likely that this growth will slow over the next few years as it becomes more difficult to further increase the recovery rate of garden waste from the municipal waste stream.

The policy drivers have now turned to food waste, where collections and processing capacity have grown rapidly over the past few years, albeit from a low base. The costs of residual waste disposal will increase further over coming years, making food waste recovery look more commercially attractive. However, there needs to be commensurate growth in capacity and in the markets for the end products. The following special topic analyses food waste processing in more detail.

Background on composting and aerobic digestion

Composting involves the rapid decomposition of organic materials, accompanied by self-heating which sanitises the material, followed by a cooler, slower decay of the woodier plant organic matter. The whole process takes three to six months and produces a crumbly, soil-like product that is a good source of organic matter and nutrients and can be beneficially applied to most soil types. When the composting process is complete, the compost is graded to achieve a suitable particle size for different applications.

Windrow composting: Garden wastes can be composted in the open air in elongated piles called windrows. The windrows are monitored throughout the composting process to ensure that the optimum temperature, oxygen concentration and moisture content are maintained. The windrows are turned periodically to introduce fresh air and watered to maintain the ideal conditions for composting. It is estimated that about 80 per cent of recovered organic wastes are composted through this method.

In-vessel composting (IVC): Household food wastes and other meat-containing food wastes need to be composted under controlled conditions to comply with Animal By-Products Regulations. This is to ensure that any pathogens are killed and also that there is no access to wild animals. In-vessel composting is similar to the open-air windrow composting, but is carried out in an enclosed vessel, usually followed by an outdoor maturation stage. This allows a greater degree of control of the process temperature, oxygen and moisture. Currently, about 15 per cent of recovered organic wastes are composted in-vessel.

Anaerobic digestion (AD): Unlike composting, AD is carried out in an oxygen-free (anaerobic) environment. The feedstocks are placed in a warmed sealed airless container, where they ferment (digested by bacteria) to produce a biogas which can be used as a fuel, and liquid and solid 'digestates' which can be used as fertilisers and soil conditioners. At present, AD accounts for a small fraction of organic waste treatment, but this proportion is expected to grow rapidly over the next few years. AD has the ability to treat wetter waste streams, so it is particularly suited to industrial feedstocks and municipal food wastes.

In-vessel composting.

Special report:
Food waste processing and anaerobic digestion

The UK's landfill diversion targets require the amount of municipal biodegradable waste being sent to landfill to fall by around 10 million tonnes by 2013. Since food waste is one of the largest remaining fractions in the municipal waste stream, food waste diversion could make a large contribution to meeting the UK's targets.

The most cost-effective way of reducing the amount of food waste being sent to landfill is to prevent it entering the waste stream, either through reducing municipal food waste or through promoting home composting. Both of these strategies have a role to play, and WRAP research suggests that over the next five years they could together divert an additional 1 million tonnes from landfill.[6]

Nevertheless, it is expected that over 5 million tonnes of food waste per annum could remain in the municipal waste stream by 2013 unless action is taken. Less than 5 per cent – around 250,000 tonnes – of food waste is currently recovered and processed. If this proportion were to increase to 20 per cent, an additional 1 million tonnes of food waste could be diverted from landfill, making a significant contribution to meeting the UK's landfill diversion requirements.

WRAP analysis suggests that once the costs of disposing of residual waste (including transport) exceed £70 per tonne, separate collection and processing of food waste becomes financially attractive. As discussed earlier, recent and projected increases in landfill tax rates are pushing disposal costs towards this point. When combined with the prospect of potential fines under the Landfill Allowances Trading Scheme (LATS), this provides local authorities with a strong financial driver towards the diversion and treatment of food waste.

Set against this, building an additional 1 million tonnes of annual food waste processing capacity will require a capital investment of the order of £150-£300 million over the next five years.

By 2013, over 5 million tonnes of food waste per annum could remain in the municipal waste stream, unless action is taken.

Composting vs. anaerobic digestion

Household food waste and other meat-containing food wastes have to be composted in facilities approved under the Animal By-Products Regulations. Around one fifth of composting sites are currently authorised to accept food waste or in the process of applying for authorisation. The most common technologies are in-vessel composting (IVC) or anaerobic digestion (AD) (see Background on composting and AD, page 8).

IVC activity doubled between 2003/04 and 2005/06 to around 500,000 tonnes and is likely to have grown significantly since then. The feedstock to IVC facilities can comprise a maximum of around 60 per cent food waste, but few IVCs are currently operating at the maximum food waste capacity.

Unlike IVCs, AD facilities can treat feedstocks that comprise 100 per cent food waste. There are fewer than ten AD facilities that currently accept municipal food waste, with recent estimates suggesting that they may be processing up to 50,000 tonnes per annum of segregated municipal food waste. Market contacts have indicated that up to a further 60 sites are under consideration, although market conditions will determine how many of these come to fruition.

Across Europe, there are estimated to be 124 commercial scale AD plants with a combined capacity of around 4 million tonnes, of which around one quarter is currently used for treating source segregated organic waste.[7]

The evidence suggests that AD treatment of separately collected food waste may be more cost-effective than IVC of mixed food and garden waste for some local authorities, despite the higher capital costs of AD systems and the higher collection costs associated with collecting food waste separately.

[6] *Source: WRAP (2007), 'Sustainable ways of dealing with household food and garden waste', based on research by Eunomia Research and Consulting.*

[7] *Source: RPS (2007), 'A review of anaerobic digestate and markets originating from food waste rich feedstocks' prepared for WRAP.*

One reason is that if food waste is added to existing garden waste collections, then all the material has to be processed via an IVC system. Because IVC has significantly higher gate fees than windrow composting, the additional disposal costs substantially offset the potential savings in collection costs.

A second reason is that a higher capacity utilisation can be achieved with AD than with IVC because there is less seasonal variation in food waste arisings than in garden waste. And the third reason is the value of the biogas captured during the AD process (see below).

Moreover, lifecycle assessment analysis has indicated that anaerobic digestion of source segregated food waste is likely to give better environmental outcomes than in-vessel composting of mixed food and garden waste. Again, this is primarily because of the potential of AD to generate heat and energy.

AD is not a panacea, however, and it will not be suitable for all local authorities. The feedstocks to AD need to be managed much more closely than those for IVC to ensure that the anaerobic decomposition is not compromised. The costs and time associated with obtaining permits and grid connections can be high. A further disadvantage is that AD requires households to have an additional container for food waste.

Markets for the products of AD

The largest source of revenue to an AD plant is from sales (or avoided costs) of electricity and heat generation. However, in order for an AD plant to be commercially viable, markets also need to be found for the solid and liquid digestates.

The biogas produced by an AD plant is predominantly composed of methane (60%) and CO_2 (40%), with traces of other gases. About one third of the biogas is required to sustain the temperature of the plant, but the remainder is surplus. This can be used for other purposes, such as a fuel for a boiler to heat nearby buildings or for an engine connected to a generator to produce electricity – which can be used or sold to the grid. Combined heat and power (CHP) plants, which generate both heat and electricity, provide a more efficient use of the fuel. Less commonly, the methane can be used as a vehicle fuel or cleaned to feed into the natural gas stream.

Each tonne of food waste generates 100-150m^3 of biogas, which in turn has the potential to generate a net 300kWh of electricity. Given recent prices for renewable energy of around £100 per MWh,[8] this suggests revenues in the order of £30 per tonne of input material. If AD becomes eligible for double Renewable Obligation Certificates (ROCs), as is proposed, this could increase the value of the biogas fraction by a further £15 per tonne.

Each tonne of food waste is estimated to produce around 0.83 tonnes of digestate, which can be separated out into liquid and solid fractions. The liquid digestate is a fine slurry containing nutrients from the decomposition process which can be used as a fertiliser.

The solid digestate typically comprises organic fibres which can be either used without further treatment as a soil improver or can be further processed to yield a compost that can be used in growing media. If the solid fraction is composted, this leads to a further reduction in the dry weight of about 20 per cent.

There are a number of potential markets for digestate including agriculture, regeneration of contaminated land or organically depleted soils, or as landfill cover. The primary market is likely to be agriculture, although not all agricultural land is suitable, for example, because of specific site circumstances or limitations on the use of fertilisers in nitrate vulnerable zones. Alternative markets that have been considered include using the solid digestate as a biofuel, and research has also been undertaken into the possibility of using the solid fraction in plastic composites.

There is little information about prices for anaerobic digestates although recent estimates for digestate delivered to an agricultural end market – whether in whole, solid or liquid form – range from -£5 per tonne to a few pence per tonne.

Conclusions

The diversion requirements under the EU landfill directive coupled with increasing costs of residual waste disposal are increasing the pressure to source segregate and process food waste. Anaerobic digestion appears to be an attractive option, in large part because of its potential as a source of renewable energy, although it is not suitable for all local authorities. A key challenge is finding suitable and sustainable end markets for the digestate.

Each tonne of food waste generates 100m^3-150m^3 of biogas, which in turn has the potential to generate a net 300kWh of electricity.

[8] *Source: NFPA. This includes the value of the ROCs.*

WRAP helps individuals, businesses and local authorities to reduce waste and recycle more, making better use of resources and helping to tackle climate change.

You can learn more about WRAP at:
www.wrap.org.uk

Or to learn more about recycling, visit:
www.recyclenow.com

Waste & Resources Action Programme

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