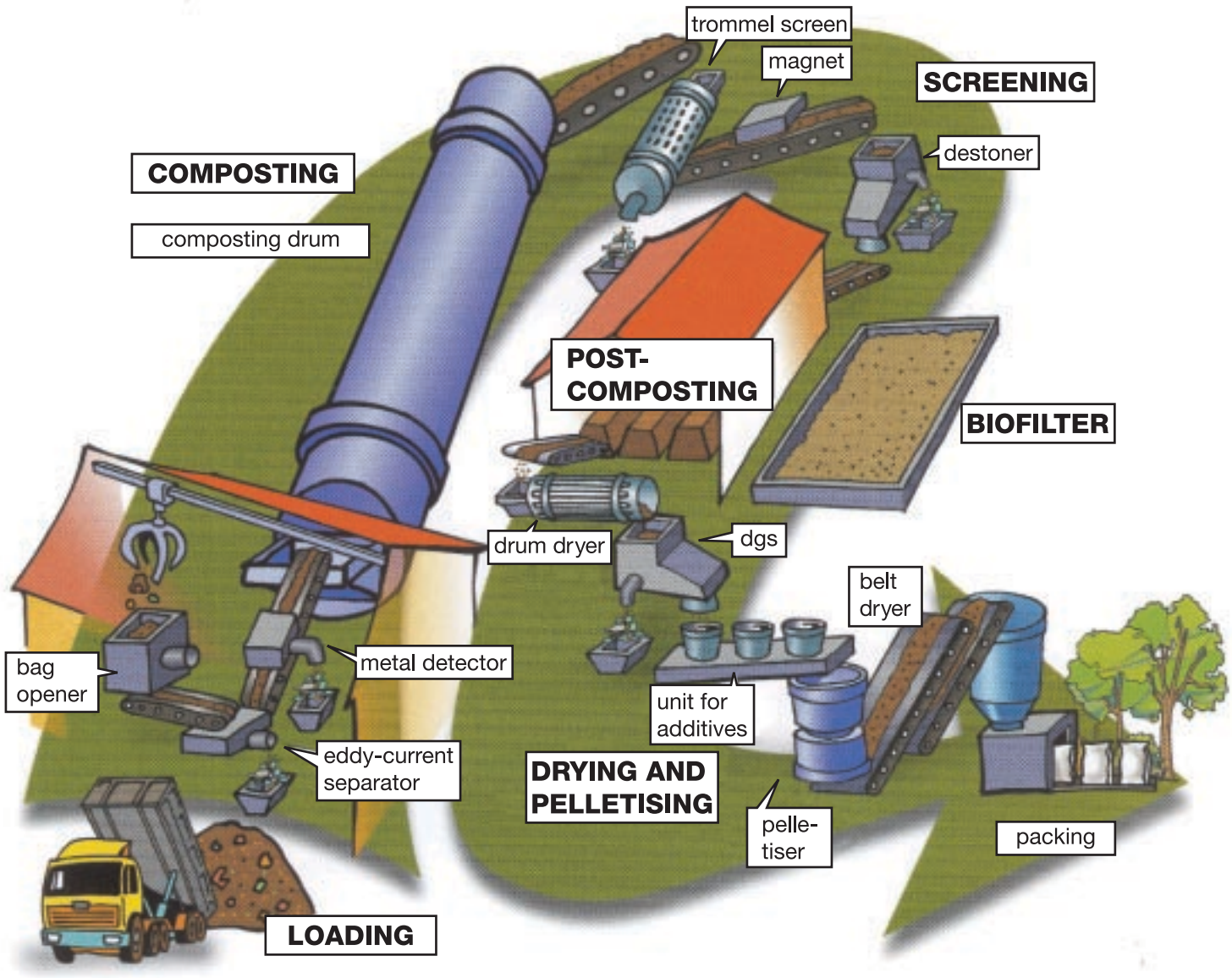
How to comply with the Landfill Directive without incineration: a Greenpeace blueprint

GREENPEACE



Energy from waste = a waste of energy. Plastics and paper are the main source of calorific value in an incinerator. Burning plastics, which are oil based, is effectively burning fossil fuels – the main factor behind global warming. Paper is produced from wood by an energy intensive process. Burning it wastes energy and resources as well as generating pollution.

Contents

List of information Boxes

Executive Summary

Landfilling of municipal waste has to be reduced for a variety of reasons. The current practice of landfilling mixed municipal waste is highly polluting, as well as unpopular and ultimately unsustainable. Now the European Landfill Directive, which came into effect on 16 July 2001, demands significant reductions in the quantity of biodegradable waste disposed of in this way. As part of the drive to comply with the Landfill Directive, the Government has set mandatory recycling targets for local authorities.

Some local authorities are arguing that incineration is necessary to meet the UK's commitments under the Directive, or to deal with residual waste left after maximum practical recycling levels have been achieved. Neither of these arguments is tenable.

If the UK does nothing more than recycle or compost 30% of newspaper, card and organic waste, we will have met the 2010 target in the Directive of reducing biodegradable waste going to landfill by 25% of 1995 levels. This target and the 2013 target of 50% can easily be exceeded with technology currently available and in use. The 2020 target of 65% may be more demanding, but we can learn from cities and regions around the world that have already achieved more than this. The Directive gives the UK almost two decades to put in place the necessary systems.

The techniques and technology needed to meet the Landfill Directive targets should also enable local authorities to meet the UK Government's mandatory recycling targets. Once implemented, the strategy set out below will ensure recycling is maximised, and provide the means to go beyond currently perceived limits to recycling.

Organising efficient kerbside collection and composting of kitchen and garden waste is the single most significant step authorities can take towards meeting the Landfill Directive and recycling targets. Getting this stream right is the key – taking us from waste management to waste utilisation.

The basic infrastructure for managing source separated domestic stream materials can also be used for recyclable and organic material from trade and other non-dustbin streams.

Residual Waste

When the types of collection, composting and recycling systems described below are in place, residual waste can be reduced to a very small fraction of the municipal waste stream. Eventually, these residuals can be dealt with by a combination of regulatory, fiscal and consumer driven mechanisms such as producer responsibility legislation (e.g. the Waste Electrical and Electronic Equipment Directive), disposal taxes (e.g. the Landfill Tax and an incineration tax) and design efficiency. In the meantime, material that cannot be re-used, recycled or composted, should be cleaned and stabilised, then landfilled.

Mechanical Biological Treatment (MBT) systems, which stabilise and reduce the volume of residual waste still further, can be used to achieve this cleaning and stabilising function at the 'back end' of kerbside collection, composting and recycling schemes. They can also provide the 'failsafe' that some managers are currently seeking – a way to guarantee mandatory targets are met.

There are several reasons why using landfill for cleaned residual waste is better than building incinerators, the most important of which are:

- Unlike incineration, landfill does not perpetuate the need for waste. Source separation schemes like those outlined here mean that residual municipal waste will be less toxic and much reduced in volume compared to current levels. Continuing improvements in recycling, product design and buying habits mean landfill can be reduced incrementally and eventually phased out. Incinerators on the other hand must operate at near capacity throughout their 25-30 year lifetime if capital investments are to secure a return. Once built, they are a structural impediment to significantly reduced levels of waste disposal.

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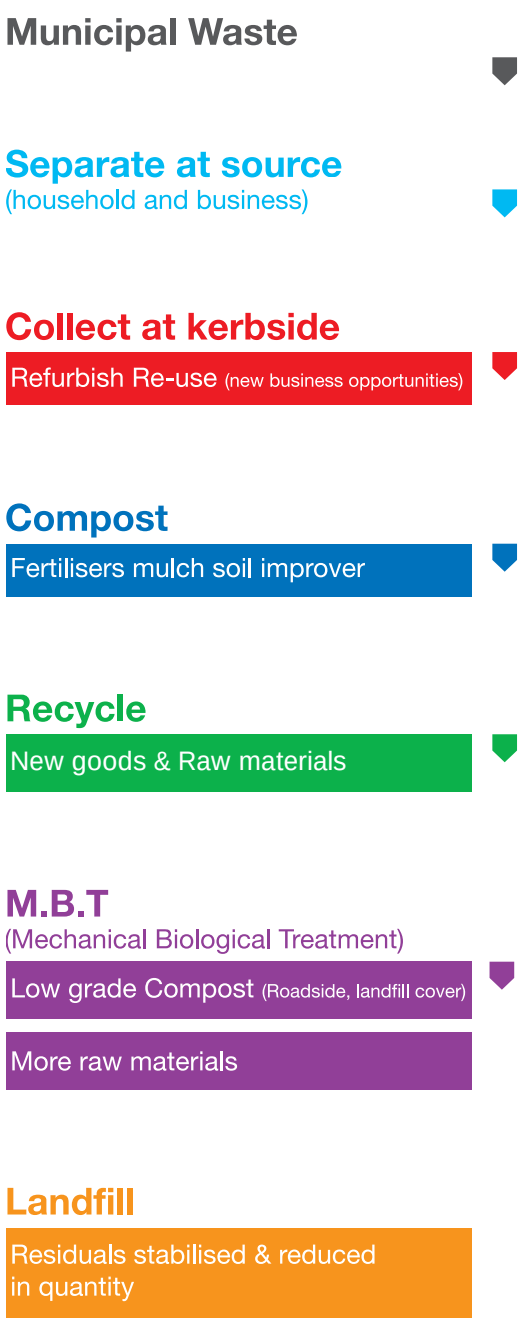
- Incinerators do not eliminate the need for landfill. They produce contaminated ashes that have to be landfilled, as well as air pollutants. Highly toxic pollution control residues often have to be transported many miles for burial. Incinerators do not solve the problems of landfill and create new ones.

When considering options for the disposal of materials that cannot be recycled, it is important to be aware that incinerators can achieve a maximum 70% reduction in the mass of waste incinerated (30% is left as ash). Reduction in volume compared to landfill, where waste is normally compacted prior to burial, is even less – around 45%.[1] The actual reductions of municipal solid waste achieved by mass burn incineration is around 55% by weight as non-combustible material (so called by-pass) has to be sorted and removed from the stream before burning.

Current state-of-the-art mechanical screening and composting systems exceed the reductions in mass and volume achieved by incinerators. At the same time they eliminate the pollution problems associated with incinerators. When carefully planned and managed, they can provide a useful, marketable product that can return nutrients to the soil and rebuild soil quality. They also provide a method of recovering valuable resources such as aluminium.

Examples from around the world show that using current technology, councils can achieve diversion rates that smash the 60% 'barrier'. The inhibiting risk aversion that pervades waste management in the UK needs to be replaced with a culture of imaginative problem solving and a new 'waste utilisation' approach. The quest for convenient 'magic box' solutions that deal with mixed municipal waste must be replaced with an energetic and forward-looking search for flexible solutions that eliminate dependence on polluting and unpopular 'burn it or bury it' technologies altogether.

How to meet the landfill directive without using incineration



Meeting the Landfill Directive targets

'It is entirely possible to achieve the Landfill Directive without using incineration, using a flexible 'pick and mix' option. Such an option would utilise source separation, kerbside collection, composting, recycling and mechanical screening to deal with municipal waste in a way that actively contributes to the economic, social and environmental goals of sustainable development.'
– Peter Jones, Director, Biffa Waste Services

The European Landfill Directive sets mandatory targets for a three step reduction in biodegradable waste going to landfill. Set against a 1995 baseline, it requires a reduction of 25% by 2010, 50% by 2013 and 65% by 2020.

The targets apply only to untreated biodegradable municipal waste. They are intended to reduce the role of landfill in producing methane, a potent greenhouse gas, as well as reducing the quantity and toxicity of leachate produced by landfill sites and the volume of waste landfilled. According to Government estimates, 60% of the current municipal waste stream is thought to be biodegradable.[2] The real figure may be higher than this.

One way of meeting the first target of a 25% reduction would be to recycle or compost just 30% of newspaper, card and putrescible waste. We have until 2010 to do that. Any local authority that cannot meet that target without resorting to incineration deserves to have serious questions asked about its policy and management. In fact, much greater recycling rates than this can be achieved. Once the initial investment is made in effective systems, the cost per tonne for waste management begins to decline significantly.[3]

It is necessary to reduce the amount of all types of waste going to landfill. But it is not desirable, or necessary, to do this by increasing reliance on incineration. Incineration is hugely unpopular and highly polluting. And it does not solve the landfill problem. 30% by mass of the waste burnt remains as ash and 15% of municipal waste by-passes incinerators as large non-combustible items.

Cities and regions in Canada, the USA, Australia and New Zealand have achieved significantly larger reductions in landfilling – up to 70% – without using any incineration. Moreover they have done this relatively quickly, generally in a period of five years or less. In the UK, there are several examples of communities that have achieved recycling rates of over 50%.

Many waste professionals in the UK see a dramatic increase in recycling and composting as severely constrained by logistical, cultural, technical and economic factors. Some put a limit of around 50% on what they believe can be diverted. Any strategy has to be shaped with respect for the experience of waste managers, but the experience of municipalities and regions in other countries also provides valuable insights. Leading waste authorities elsewhere have reached 60% diversion and are now planning strategies to reach 85%. Edmonton in Canada has already attained a 70% diversion of residential waste from landfill without any incineration. In the UK, Essex has been the first county to adopt a 60% target by 2007, and its first pilot scheme is already approaching this target. According to Peter Jones of waste management company Biffa, 'Most in the industry agree that at least 60% is a realistic target for diversion from landfill into biodegradation and recycling.'[4]

Mersea Island, Essex
Mersea Island has achieved a recycling rate of 57% and a participation rate approaching 90% in the 4,500 households covered by its recycling scheme.

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There is no doubt that there are challenges to reaching high diversion rates: setting up new collection methods, ensuring public participation, finding markets for collected materials. Others have faced the same challenges and solved them. In the UK, we are currently at the very bottom of the league when it comes to 'waste utilisation'. But that gives us one advantage. We can look at others to see what is possible and get some ideas on how to achieve it.

This briefing is intended to map out the general features of a sustainable waste management (or waste utilisation) system, by highlighting technologies and best case examples from around the world. The principles, techniques and technologies outlined in this report represent the best environmental options, and are applicable to metropolitan and rural areas alike. The details and implementation need some imaginative thinking from decision makers and waste managers!

Wye, Kent

The WyeCycle community composting and recycling scheme has enabled the local authority to reduce mixed waste collections to once a fortnight for 1000 households in Wye and Brook. Weighings of residual waste put out for collection show average waste production to be down to 250kg per household per year. (UK average is approx 1 tonne)

- Glass, paper, metals and textiles are collected weekly in a black recycling box
- Kitchen waste, including vegetable, fish and meat waste is collected weekly & composted.
- Garden waste is collected separately
- All compost produced is sold as a soil conditioner and mulch

Contact Richard Boden,
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Source Separation – as easy as 1-2-3

The first principle of any waste management scheme that hopes to achieve high diversion rates and good quality recyclables is source separation of waste. This means kerbside collection of three streams:[5]

- dry recyclables
- compostable material
- residuals

Additionally, hazardous materials (paint, oil, pesticides, fluorescent light bulbs etc) should be kept out of the municipal waste stream, either by separate collection or by utilising "bring" points at civic amenity sites, or a combination of both.

Stream 1 – wet organics

After source separation, composting is the most important step towards sustainable waste management.

Composting quickly reduces the volume of waste landfilled. All waste authorities achieving 50% plus recycling levels have paid close attention to the collection of the organic stream.

Separation of the organic stream reduces the toxicity of residual waste because it removes organic acids, which dissolve heavy metals in the waste and cause them to leach. In fact, it is the organic material in landfill that causes many of the environmental problems associated with this form of disposal.

Profiting from waste – Isle of Wight
Demand for compost produced from household waste on the Isle of Wight far outstrips supply – the source separated green and organic waste produces high quality compost used by local tomato growers. Compost mechanically sorted from residual mixed waste is used as a landfill cover material that would otherwise have to be imported onto the island.

Contact Sarah Humphries, Island Waste Services, **Tel** 01983 821234

Instead of being a disposal problem, organic household waste can be used to generate useful end products that have both a market value and an environmental value.

Organic waste often makes up over 40% of the household waste stream. Diverting the full range of organic materials combines with dry recycling to dramatically reduce the volume, weight and odour causing potential of the residual stream. The organic and dry-recyclable stream can potentially take 70%-80% of total household waste.

Diverting food waste is the step that crosses the threshold from 'add-on' recycling/composting services to a true three stream system. It brings high diversion levels within councils' reach and is a useful source of nitrogen where high quality, high value, compost is the objective.

Garden (green) waste can be diverted rapidly and at low cost. Its diversion enables waste managers to make major cost savings. It is relatively easy to handle through home composting, at Civic Amenity (CA) sites, through wheeled bin or paper sack kerbside collections, and at central composting sites.

Experience has shown that it is generally best to treat the green garden waste and kitchen waste as two separate streams. Food waste has a high density, hence can be collected in small buckets and does not need compacting. It will need composting at enclosed facilities due to the presence of meat and fish. Green waste is low density and best compacted when collected. Separate collection also allows green and kitchen waste to mixed in the correct proportions for the required end products.

Garden waste Home Composting.
Home composters cost £10-£15 per unit and divert an average of 120kg per household per year, and in some cases up to 250 kg. Over ten years, this means the Council pays a maximum of £15/tonne to divert this material – with savings including disposal costs (£20-£35/tonne), refuse collection costs and gate fees at central composting sites.

After source separation, composting is the most important step towards sustainable waste management.

Home composting is the best option for garden waste, but it will also be necessary to offer a collection service.

Collection of garden waste

Current resources can be used in new ways to minimise the infrastructural costs of increasing the quantity of material collected and recycled.

One possibility is the weekend collection of green waste in refuse collection vehicles (RCVs), which are often unused on these days. This low cost way to begin diverting organics provides large quantities of clean green materials for central composting sites. Further savings are available by running the service only during the 8-9 peak green waste months.

Green waste collections can cut costs and generate income through two additional methods:

- Local authorities already have the power to require that households separate green waste from refuse – thus increasing participation
- Many already charge for special green waste sacks (10p-£1/each)

Weekend collections + charges for sacks + a nearby composting site + gate fees £15-£20/tonne + disposal credits (in some counties) = a smart, cost-effective step in the diversion of the organic stream.

Kitchen waste – getting all the organics

Programmes across Britain (e.g. Daventry, Rochford, Wye) and elsewhere show that collecting food waste can reduce the volume of residual waste tonnages, and permit fortnightly rather than weekly collections, saving up to £100,000 per refuse round. Food waste also improves the texture, moisture and nutrient content of compost when mixed with green waste.

To date there is little data on kerbside collection costs for compostable waste, however a figure of about £10 per household per year has been suggested.[6]

Wealden, East Sussex, has increased its recycling rate from 4% to 53% in two years in areas where it has introduced kerbside recycling. It uses a wheeled bin collection of garden, uncooked kitchen waste and cardboard, a kerbside box for mixed paper, cans and foil and a wheeled bin for residual waste. The kerbside box and green waste bin are emptied one week and the residual refuse bin is emptied the next using the same vehicles and crew.

The initial approach of giving households a single recycling box had little effect on recycling rates. Change came when the council began to collect green compostable waste. Two further innovations increased capture rates – a restricted capacity of the mixed waste bin (through fortnightly collections), and a firm line with people who persisted in mixing their rubbish: their bins were not collected. The result was almost total compliance.

When new areas are included in the scheme collections are carefully monitored for the first six weeks and specific advice given to householders on an individual basis.

The Government strongly supports the composting of waste, this is a vital component of meeting Waste Strategy targets for recycling and composting and targets under the Landfill Directive to reduce the landfilling of biodegradable municipal waste

Collection of kitchen waste

There are two main methods of collecting food waste at the kerbside:

- Mixed with green waste and potentially cardboard in wheeled bins @£12-£18/unit, or in reinforced paper sacks @20p
- Separately in a small bucket or other compost container @£2-£8/unit

The two principal practices used to accomplishing cost efficient collection of organic waste are to introduce alternating fortnightly collections of refuse and organics; or fortnightly residual refuse collections with weekly organics. Weekly collection of kitchen waste should be given preference where possible as this minimises potential odour problems and is therefore more readily accepted by the public.

Richard Boden of WyeCycle offers the following advice for achieving maximum collection rates:

- Treat kitchen and garden waste as two separate streams
- Collect all kitchen waste
- Ban garden waste from the mixed waste bin
- Make a charge for collection of garden waste (so smaller properties which produce little of this waste are not subsidising householders in larger properties which produce a lot).
- Don't provide a wheelie bin for garden waste
- Do not collect mixed (residual) waste weekly
- Do collect kitchen waste weekly

'Organise your organics' – Isle of Wight

On the Isle of Wight over 15,000 small buckets for collecting organic waste have been distributed to households that have requested them. The service began in December 1998, about 30% of households on the island participate and this figure continues to rise. Most island schools also separate their waste.

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The Animal By-Products Order

Organic waste, including kitchen and catering waste that may contain meat, will be subject to new EU regulations due to come into force in Spring 2002. These regulations are intended to control the transport, handling and disposal of animal derived products in order to increase food safety. They will stipulate that such waste must be composted in an enclosed environment and must reach a specified temperature (likely to be 70°C for 60 minutes). The EU Animal By-Products Regulation will allow composted kitchen waste to be used on all land except pasture land, used for grazing animals.

This means there will be a huge potential market for properly composted household kitchen and garden waste; agricultural and horticultural uses, greenhouse growing, retail for the domestic market, turf growing, landscaping, roadside soil improvement, mulching applications etc.

DEFRA sees composting as vital to the future of waste management:

"The Government strongly supports the composting of waste, this is a vital component of meeting Waste Strategy targets for recycling and composting and targets under the Landfill Directive to reduce the landfilling of biodegradable municipal waste…Where catering or household waste contains meat or other products derived from animals then, although it may be composted, it may not, currently, be used on land…where animals (including wild birds) may have access. However this position is set to change. The draft EU Regulation on Animal By-Products will allow the use of properly composted mixed waste on all land except pasture land. We expect this regulation to come into force in the Spring of 2002."

DEFRA Briefing note on composting 21 June 2001

There will be no restrictions on the composting or use of green waste (garden waste).

In-vessel composting systems ensure the absence of odours, that pathogenic organisms are killed and a high quality compost.

Utilising the collected material – composting technology

When choosing the best compost system it is important to consider the operational aims and whether the chief objective is to manage the waste stream as cheaply as possible, to reduce the organic content of the residual waste stream or to produce quality compost. The priority given to each of these will influence the type of system needed.

Windrow systems

Areas which contain or border on farms, rural spaces or landfills can often compost their organics centrally at an open, windrow site. This is the traditional method of composting in elongated heaps that are periodically turned. Climatic conditions and feedstock properties are important considerations in determining the suitability of windrow composting. Oxygen content, temperature and moisture content should all be monitored and controlled. Cost of windrow composting is normally around £15-£20/tonne of waste. Before investing in windrow composting systems local authorities need to be sure that they will be able to meet future regulations in terms of pathogen kill, quality of the final product and odour and dust emissions. In this respect, in-vessel systems have distinct advantages.

In-vessel composting

In vessel composting systems allow greater control of the process and of its outputs. For dense, urban areas, a range of enclosed, in-vessel systems also ensure the absence of odours and cut transport and land costs. A high temperature can be obtained across the whole composting mass to ensure pathogenic organisms are killed. Composting is also quicker under these more controlled conditions. Operating costs tend to be higher than for windrow systems, but in terms of quality control, pathogen kill, land use and public acceptability, in-vessel systems will generally pay dividends. Some land, indoors or out, will normally also need to be set aside in which the compost can mature. Capital costs are typically between £3 million and £4 million per 20,000 tonne throughput.

A Vertical Composting Unit. VCU sites in Australia and New Zealand process a wide range of organic materials – including green waste, food processing wastes, paper and sewage sludge.

Vertical Composting Units – odourless, small footprint, low cost

By raising the composting process into 6 to 12 metre high vertical compartments, Vertical Composting Units's (VCUs) greatly reduce the land area required. A single VCU will process up to 1500 tonnes annually, on a area of 11m^2 – while a 10 unit placement will process 10-15,000 tonnes on under 200 m^2 of concrete. The critical advantage for urban waste managers is that VCUs can be easily placed at CA sites, waste depots, within some Materials Reclamation Facilities (MRFs) or directly attached to organic-waste generating firms or facilities.

The VCU process was designed by microbiologists to break down and eliminate odours within the chamber. The enclosed chambers make it impervious to pests and vermin. Gravity draws the organic material down through the system, reducing the number of moving parts and operational costs. Naturally generated temperatures reach over 75°C, ensuring a pasteurised and odour stabilised end product. The system requires as little as 11kWh energy to process a tonne of waste.

VCUs have a capital cost of around £70,000 for one unit. One operative is able to feed up to 5 units. CA sites generally offer the lowest cost composting through VCUs. Capital, equipment, running and maintenance costs are £15-£20/tonne if every component must be purchased – but at CA sites these costs fall to the £10/tonne range.

Anaerobic digestion

Anaerobic digestion is an alternative form of composting, which takes place in an oxygen-free environment. It produces two streams of useable products. The first is biogas (consisting primarily of methane and carbon dioxide with small amounts of hydrogen sulphide and other gases) which can be burnt to generate electricity or heat or used as a vehicle fuel. The second is a 'digestate' – a thick slurry or near solid residue. Assuming contaminated waste has not been used as the feedstock, this can be used as a nutrient rich soil conditioner or liquid fertiliser.

There are about 70 plants operating around the world that use MSW (Municipal Solid Waste) as a feedstock. Anaerobic digesters currently have higher capital and operating costs than composting systems, and there will be emissions from burning gases for energy. The best results from this technology have so far been achieved in conjunction with sewage sludge handling systems. However, contaminated feedstocks will result in contaminated residues.

Multi-story blocks

Experience in North American cities and pilot schemes in the UK have shown that high capture rates from high rise and multi-story blocks are possible and can have significant benefits. Convenience is the key. Modification of waste chutes has proved successful but costly. Door to door (or floor to floor) collection schemes can offer a greatly improved waste disposal system for high rise tenants. The convenience of putting out waste for recycling rather than taking it to a paladin or chute provides a major incentive for recycling beyond any householder commitment to the principle of recycling.[7] Costs of door to door collection systems are partly offset by recycling credits, avoided disposal costs and reduced cleaning time from blocked chutes and overspilling paladins. The key to success seems to be in getting residents to see the benefits in terms of an improved service. Pilot schemes in London have shown that the improved service to residents, together with appropriate educational measures can achieve 58% set out rates and 75% participation.

Stream 2 – Dry Recyclables

Building a successful basic recycling programme.
'Core' dry recyclables are 30%-40% of household waste (paper, metal cans, glass bottles and textiles.) They can usually be collected through a simple box and vehicle and bulking system. On their own, they enable a 15%-20% recycling rate to be achieved. It is vital that these systems not only maximise their performance – and minimise their costs – but lay a sound basis for adding the 'expanded' range of recyclables as a next step. A comparative study of the alternative collection methods available, which includes transport, labour and capital packages, is important with regard to individual circumstances, but recent experience in the UK has identified three key factors and innovations which can ensure that performance is maximised:

A – Education is the #1 factor in recycling success
The financial value of investing in education is easy to calculate. If a recycling system presently has 40% participation, and if those participants are separating out 40% of their recyclables – then just 16% of available recyclables will be set out for collection. It requires a solid educational campaign to increase those rates. If participation and separation rates are increased to just 60% and 60% (= 36%), this will more than double the materials set out. An 80% x 80% performance (=64%) will quadruple materials collected. It is a far better financial decision to spend 50p or £1 per household to get more materials set out in the first place, than it is to add another vehicle or piece of materials reclamation equipment.

Resources currently discarded have been described as urban mines because of the untapped resources they represent.

‘Core’ dry recyclables are 30%-40% of household waste (paper, metal cans, glass bottles and textiles.)

Successful recycling programmes provide some key insights in ‘how to do’ recycling education.

- Keep It Simple
- Always Use Graphics
- Make It Personal
- Target Feedback
- Repeat, repeat, repeat

Sending someone to the door to deliver the box and answer any questions is much better than just dropping a box with a brochure in it on a doorstep. Successful programmes have used local residents or the new kerbside collection staff to make the delivery personal, answer residents questions and encourage participation. Feedback cards are also useful. Waste composition studies will reveal which materials households don’t know they can recycle, enabling managers to target the ‘missing’ materials for follow-up promotions. These often focus on high-value aluminium cans and textiles, and can rapidly boost overall programme sales revenues.

After (but not instead of) education, there is no doubt that some gentle coercion can increase quantities collected dramatically and rapidly. Some European cities return bins unemptied, with an explanatory sticker, if organic waste has not been separated. Some impose a fine for non-separated waste, others charge for waste collection by weight or volume. Rebates or cash incentives for households that do source separate may also increase participation rates.

Halifax, Nova Scotia, Canada.

Severe environmental problems resulting from an existing landfill, together with opposition to the introduction of incineration resulted in a system based on three stream kerbside collection which has enabled Halifax to reach a 65% diversion from landfill rate.

Halifax Regional Municipality (HRM) has a population base of approximately 350,000, comprised of some 133,000 households. It has an annual waste generation of 260,000 tonnes. For years, the municipalities - Halifax, Dartmouth, Bedford and the more rural Halifax County - relied on landfill as the primary waste management method. One of the criteria established by the Community Stakeholders Committee, who participated in the waste strategy planning process, was that no raw organics, could be sent to landfill. The group concluded that rather than have to spend time and money maintaining waste degrading at its own rate in a land-fill, it made more sense to force it to degrade in a controlled environment, accelerated as much as possible, and landfill a stable waste.

Stakeholders felt that basing the collection and management programme on source separation was the best route to take. They believed that if the system only relied upon mixed waste processing at a centralised plant, there would be no incentive for people to learn about waste management and to make proper purchasing decisions. Ensuring the programme was based on source separation meant source reduction and reuse would also take place.

The CSC strategy specified that waste be separated into three streams: recyclables, compostables and refuse. (Household hazardous waste is also collected). The plan also called for construction of a household hazardous waste facility, a state-of-the-art landfill, a front-end mixed waste processing and back-end stabilisation facility, and composting plants.

The programme

The system includes:

- Source separation of organics, recyclables and residual waste fortnightly collection of organics and residual waste
- weekly collection of recyclables (biweekly in the rural areas of the county)
- use of aerated carts for organics collection
- a site that includes a mixed waste processing facility designed to handle 119,000 tonnes/year of MSW, a thirteen channel agitated bed composting system to process the mixed waste after recyclables are removed
- landfill for stabilised waste.

The total solid waste stream is roughly 55% residential and 45% commercial. The institutional, commercial and industrial sector is responsible for its own collection. Tipping fees are designed to encourage IC&I source separation. They are set at $68 (Canadian) per tonne for separated organics and $100 per tonne for mixed waste.

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B – New collection technologies.

The success of kerbside schemes depends heavily on the collection method employed. It determines the participation rate and levels of contamination of collected material. Getting the collection right is crucial. Participation rates are closely linked to the convenience of the systems. At the same time the collection method must be compatible with the treatment technology. Collection and disposal authorities must work together on this.

High-productivity, low cost recycling vehicles.

Most recycling vehicles developed in the 1980s had multiple fixed compartments, often with hydraulic lifting equipment, cost £70-£120,000, and have a long wide profile. Such vehicles simply do not work in many parts of the UK. This has resulted in a number of collection vehicle innovations:

Pedestrian Controlled Vehicles (PCVs).

PCVs are small, electrically-powered, recycling vehicles currently used to collect recyclables from 100,000 households in Haringey, Islington and other parts of the UK. Manufactured in the UK, PCVs are designed to be light, no wider than a street sweepers barrow, and to travel at walking speed. Because PCVs operate on pavements, they cut the time taken to carry boxes to the vehicle.

The materials collected are sorted into variously sized, labelled, builders bags on the platform of the PCV. The bags are rolled off into empty parking spaces or other collection points once full. The operative then unfolds a new set of bags and continues collecting, while a single, larger, crane equipped vehicle (@£35,000-£40,000) collects the sacks from 6 to 8 PCVs. The fact that one crane-vehicle driver can serve

A PCV and operative at work in Islington

between six and eight collection staff (as opposed to a 1:2 ratio on most recycling vehicles) dramatically cuts costs. PCV-based recycling systems offer additional cost savings and benefits:

- Very high productivity at 500-1000 households per operative-day
- Capital costs of £8,000 (lease @ £2,500), recharging costs of 20p/night
- Widespread popularity with local residents as they are quiet and emissions free – Staff are on foot and thus easily accessible to respond to the public's questions
- They do not block traffic in narrow streets or inaccessible areas
- Flexibility is maximised as programmes can add materials simply by adding new builders bags – or a second trailing cart
- They can be stored 'remotely' in local depots/buildings, thus cutting time to/from the round.
- The use of crane vehicles means the elimination of the usual congestion at the MRF during peak hours; builders bags on the crane vehicle do not 'cube out' as cages/compartments do; and the bags can be handled easily.
- Both PCVs and crane vehicles can be used for other evening or weekend duties (e.g. collecting in city centres, markets, parks, or from bring banks.)
- PCVs can also collect kitchen organic waste.

Stillage vehicles:
are low cost (@£35,000-£40,000), flexible, and have been widely proven in their use – e.g. the community sector uses stillage vehicles to collect from hundreds of thousands of households in London, Bath and elsewhere.

Co-collection vehicles:
can be inexpensively made out of RCVs (@£15,000-£35,000 per retrofit) and can collect two of the three main streams in one pass – an approach well-suited to remote areas, offering substantial cost savings and reduced traffic.

These three methods enable communities to add a recycling vehicle for £8,000-£40,000 in capital costs – compared with £100-£120,000 for RCVs – and mean that the capital constraints holding back recycling are often much less than imagined.

C – Bulking and sorting for next to nothing.
The high capital cost and operational complexity of running a full-scale Materials Reclamation Facility (MRF) is unnecessary in the first stages of a recycling programme. For instance, both the stillage and PCV-based systems operating in London rely almost entirely on bulking materials into large Roll-on-Roll-off facilities (RORO's) using forklifts with rotating heads. In Islington, where PCVs collect from 40,000 households, the builders bags are simply bulked in an outdoor area which formerly held some recycling banks. There is thus no reason for kerbside recycling to be delayed until a full-scale MRF is built.

Expanded recycling.
There is a further 10%-15% of additional dry recyclable materials (corrugated card and card packaging, aluminium foil and aerosols, engine oil and various plastics) which, once collected, will enable a step change in recycling.

Collecting the full, expanded set of recyclables requires two basic systems changes:

- Corrugated card and plastic bottles have large volumes and low weights, so sufficient handling capacity must be provided throughout the system – especially in household storage containers and on the collection vehicles
- More types of materials means further sorting either at the kerbside or, more likely, at a MRF. If a basic MRF facility is available, recycling managers can reduce the number of sorts done on the kerbside trucks, thus generating savings on collection costs. Some schemes have found it beneficial to collect and compost card with green waste. Card can aid the composting process and provide a useful source of nitrogen.

Add cardboard and plastics… get MORE newspapers and cans. Adding the expanded recyclables has the surprising side-benefit of ALSO boosting the capture rates for the core recyclables. This seems to occur because households now find it easier to separate out ALL paper and board for recycling than they did to pick out specific grades – and because every material that is added furthers the practices and culture of recycling.

Toronto's waste plan – 60% diversion by 2006, 100% by 2010

'We are proposing transformational change, but the net result will be a simple and convenient system that will be easy for the resident to understand and take part in.'

Key assumptions to achieving its targets:

- organics will be collected each week
- anaerobic digestion will be the main treatment method for organic materials
- recyclables will be collected every two weeks
- residual resources will be collected every two weeks
- costs are based on a four-day 10-hour working week using existing staff

The practical plans:

- Just one collection truck will go down the resident's street on the same day each week; it will be a modern truck with two compartments.
- On one week the truck will collect organics from a hard, animal-proof container placed at the kerb, and also pick up recyclables which will be placed kerbside in one or more containers or bags; all dry recyclables can be 'co-mingled.' No need anymore to have a separate Grey Box for papers and Blue Box for bottles and cans.
- On the second week the organics will be picked up again, this time along with the residuals (anything that can't be recycled or composted).

'We will begin the four-year implementation of the new programme in 2002, starting with 170,000 residences. We will expand the number aggressively in the ensuing years.

When fully implemented, the net operating costs of the new system will be about $157 million per year (2006) or $160 per household per year. We asked ourselves how this would compare with other, more modest approaches to resource diversion. We were delighted to discover that it compares almost equally to keeping the status quo ($155 million or $158 per household in 2006) or just adding weekly recycling to the status quo ($158 million or $161 per household). The costs per household are the base costs and do not include debt service and indirect corporate charges. Meanwhile the big payoff is in a programme that is simpler to understand, easier to participate in, and much better for the environment that we live in.'

Waste Diversion 2010 Report, City of Toronto

Nova Scotia, Canada

A 50% reduction of solid waste going to landfill in five years has been achieved. Important elements of this model are:

- Deposit/refund on all drinks containers. (Achieved over 80% return rate).
- 100% access to kerbside recycling
- two bag collection system (green bag, blue bag)
- DoE ban on compostable organic material in landfills. (72% of residents have kerbside collection of all organic material)

Details: www.gov.ns.ca/envi/wasteman/

Glass bottles are ideal for re-use

Stream 3 – Residual Waste

The Last Resort – MBT systems

The three stream system outlined above points to a new way of thinking about the handling of residuals. Best known in Europe as Mechanical-Biological Treatment (MBT), these systems are built on the three stream logic. This moves us from a time when we could simply landfill or incinerate mixed, unsorted waste into an era of 'streaming' materials into their highest economic and environmental value.

The objective of MBT systems is to avoid putting toxics, recyclables and organics together into any final disposal option where they can interact and contaminate each other. Instead, MBT systems combine a series of treatment steps to remove as much recyclable, organic and toxic material from the residual as is possible – thereby producing an inert, 'stabilised' final product. MBT systems generally reduce the weight of the residuals they receive by a further 50%.

MBT systems enables cities and regions on both sides of the Atlantic to increase greatly their waste diversion rates – e.g. Halifax, Nova Scotia's 350,000 people boosted their diversion rate to 61% when launching their full 3-stream + MBT system; Edmonton, Alberta's 900,000 citizens reached 70% last year; and there are now dozens of such 3-stream + MBT systems across Europe, in Germany, Austria, Italy, Flanders and other regions.

The 'Bedminster' System

This modular system can be used for source separated or mixed waste. Mixed waste can be sorted manually or mechanically. Mechanical pre-sorting may include bag openers, eddy-current separators, metal detectors etc. The main component of the system is a sealed unit, rotating drum, designed to mix, aerate and homogenise the material. After the drum, raw compost is passed through a trommel for screening, and cleaned again to remove small items such as screws, paperclips and pieces of plastic. The compost can be left to mature for three to seven weeks either outdoors or indoors. Turning, aerating and sprinkling can be manual or via computer controlled automation. Sophisticated monitoring of the process and analysis of the product assure quality.

How MBT systems work:

1. Source separate first. MBTs should receive the residuals left after the maximum front-end source separation has been achieved – thus maximising the economic and environmental benefits from source-separation and minimising the size, cost and complexity of the MBT plant required.

2. The mechanical stage. Residuals are fed into a highly-mechanised front-end (to remove metals, plastics and other materials). This maximises the diversion of recyclable materials, separates of the compostable element and ensures the cleanest feedstock possible for the next stage.

3. The biological stage is usually an enclosed, in-vessel composting system which is intended not primarily to produce a saleable compost product, but rather to reduce the weight, and render inert any biologically active organic materials (that is, to 'stabilise' the residue.) The materials broken down and composted at this stage include paper and board, green/kitchen organics, and the organic content contained within nappies, packaging, textiles etc.

4. The residue is both greatly reduced in weight, and is stabilised. It can be landfilled, greatly reducing the risk of methane production, leachate difficulties and landfill fires, used as landfill cover or if contamination is low enough, as low grade compost.

Perhaps the greatest advantage of MBT plants is their flexibility – they can be built on a modular basis, and as source separated tonnages rise, the equipment and space can be shifted into high quality composting or clean MRF processing.

Perhaps the greatest advantage of MBT plants is their flexibility – they can be built on a modular basis, and as source separated tonnages, rise, the equipment and space can be shifted into high quality composting or clean MRF processing. MBT plants can be sited and constructed more quickly than a similarly sized incinerator, at a fraction of the cost. They can also be cost effectively built on a smaller scale.

Why landfill of separated, stabilised waste is better than incineration

Until we can achieve zero waste (see p.25), material that cannot be re-used, recycled or composted will have to be stabilised, then landfilled. There are several reasons why this is better than building incinerators:

- Incinerators do not eliminate the need for landfill. They produce contaminated ashes that have to be landfilled and by-pass 15% of municipal waste that is non combustible. Many incinerator operators now also reject large batches of PVC plastic because of its high chlorine content.
- Landfill does not perpetuate the need for waste creation as incinerators do (because landfill is more flexible, has a lower capital cost, shorter lead times, can operate with shorter contracts and can be designed to cope with decreasing quantities of waste). Source separation schemes like those outlined here mean that the quantity of residual waste will be much reduced and decreasing. Landfill can therefore be reduced by orders of magnitude, and phased out as we approach zero waste. Incinerators on the other hand must operate at near capacity for their 25-30 year lifetime in order to make sure capital investments secure a return. Once built they are a structural impediment to significantly reduced levels of waste disposal.
- With organic materials removed from landfill, leachate will be reduced in terms of quantity and toxicity.
- Source separation of waste means that hazardous materials will be easier to identify and keep out of the waste steam. Again toxicity of materials entering landfill will be reduced. Many toxic materials entering a mass burn incinerator are impossible to identify.
- With organic and hazardous materials (including products containing hazardous substances) removed from the waste stream the residuals will be much closer to inert. It would be acceptable to bury the small amounts of this type of inert residual waste generated after intensiv composting and recycling programmes. Incinerators on the other hand always generate highly toxic waste from thermal and chemical reactions that take place during combustion of mixed materials.
- Those that argue incineration with energy recovery is better than landfilling maintain that the energy recovered from burning waste makes it a greener option. This is not true. The two materials that supply a significant calorific value in municipal waste are plastics and paper/card. Plastics consist mostly of oil. In terms of climate impact, burning them is equivalent to burning fossil fuels. In terms of resource and energy use, it is far more efficient to recycle paper than to burn it as fuel.

When landfilling residuals, waste authorities should be sure that material that is landfilled a) has been reduced to the smallest quantity possible, and b) is as inert as possible. The way to do this is to mechanically treat residual waste befor composting using MBT systems. Landfills must be constructed using the best available technology and incorporate feedstock control to prevent the disposal of hazardous materials. Approval for landfill developments must be strictly limited to prevent over supply of disposal capacity.

The objective of MBT systems is to avoid putting toxics, recyclables and organics together into any final disposal option where they can interact and contaminate each other.

Edmonton, Canada, (population 636,000) has already diverted 70% of household waste from landfill, without using incineration. This is a recent achievement made possible by:

- Separate doorstep collection of dry recyclables, from all households (recycling rate achieved 15 – 18%)
- Mechanical separation and composting of the remainder
- "Take" collection points for household hazardous waste.

The only sorting Edmonton residents are required to do is for recyclables and household hazardous waste (2 bin system). The remainder is sent to a state of the art screening and composting facility, which produces a compost product in four weeks.

30 – 35% of material entering the composting process is landfilled. This is comparable to the solid waste volume reductions obtained by incineration, where 30% of material is left as ash and 10 – 15% is rejected as oversized non-combustible.

Edmonton residents have 2 containers. A blue bag for dry recyclables, (glass, paper, card, metals, plastic) and a bin for everything else.

1. Dry recyclables are processed at a materials recovery facility.

2. Householders are not allowed to put hazardous materials into the waste stream. Instead they must be taken to "Eco-Stations", which keeps dangerous waste out of the landfill. It can then be directed to facilities for reuse or recycling.

3. The household waste in the "everything else" bin is taken to the composting facility. There it is:

- Tipped. Oversize and unacceptable items are removed
- Screened. The material is transported by conveyor belt to a screen which removes non-biodegradable materials
- Composted. The conveyor moves the screened material to three aeration bays, where the material is regularly turned and air is drawn through it. After 4 weeks the compost is finely screened and the product is ready for marketing.

Details of the Edmonton system can be found at: http://www.gov.edmonton.ab.ca/am_pw/waste_management/

The MBT facility in Edmonton, Alberta

Thermal treatment – gasification and pyrolysis

Some local authorities are looking into the possibilities of 'thermal treatment' technologies to deal with residual municipal waste. There are several variations to gasification and pyrolysis systems. Pyrolysis heats waste in an oxygen free environment to produce gases and liquids which can be used as fuels, and
a solid residue. Gasification involves the partial combustion of materials in the presence of air, steam or pure oxygen. The product is a mixture of combustible gases, tar compounds and particulates. Some systems use a combination of both techniques. The claim is that these technologies can achieve higher thermal efficiencies for power generation than mass burn incinerators and that less pollution will be generated. Neither of these claims have been substantiated by operating plant. Although they have met with some success for homogenous feedstocks, such as coal or sewage sludge, results with municipal waste are not encouraging. There is currently very little data available for plants of the type or scale applicable to UK municipal waste. However it is clear that gasification and pyrolysis have many of the same problems as conventional incineration – i.e. the production of hazardous pollutants from chemical reactions, and the discharge of these pollutants in solid and gaseous emissions. Test data and Environment Agency licences for the pilot projects in the UK, and data from plants in other parts of the world, reveal the same pollutants released as in conventional incineration and in quantities of the same order of magnitude.

Gasification and pyrolysis are not solutions to the fundamentally dirty and flawed practice of mixing municipal waste and then trying to dispose of it. They offer no more than a possibility of reducing some of the impacts. As such they are an end-of-pipe pollution management tool rather than a solution to the problem.

Re-use

Local authorities should do what they can to encourage producer responsibility. They can also take a variety of measures themselves to increase re-use. Central to every waste strategy is a serious waste reduction programme. Refurbish and re-use schemes not only reduce waste, but also provide good quality employment and encourage small scale businesses which generate money for the local economy. Local ‘swap days’ reduce waste at minimal cost.

There are many imaginative schemes in the UK and around the world in which waste reduction schemes play a significant part in waste strategies. Local authorities also have a considerable amount of buying power. Buying large quantities of refurbished and recycled products, particularly through supply-and-buy-back agreements can help stabilise markets for recyclates and recycled products.

Aluminium moulding machine

Zero Waste (or damn close!)

Waste is not inevitable. It is the result of a series of decisions such as what a product is made of, how it is made, how it is designed, the thought put into what will happen at the end of its life etc. In this respect, a great deal of waste is the result of bad design.

Economic imperatives are sometimes the cause of this sort of bad design. A product that is cheaper than a competitor's because it can be thrown away without regard for the environment is in fact receiving a subsidy through public money spent on costs associated with its disposal. One way of internalising these costs into the cost of the product is through individual producer responsibility. Put simply, this means that if a product (and its packaging) cannot be re-used, recycled or composted then the individual producer must be responsible for collecting and safely dealing with the product at the end of its life. The financial imperatives inherent in individual producer responsibility will tend to lead to products designed to eliminate waste. European Legislation is emerging to address this issue. For example the Waste Electrical and Electronic Equipment and End of Life Vehicles Directives.

Individual producer responsibility is the final piece of the jigsaw that makes Zero Waste an achievable target. It is one mechanism by which reductions in the production of waste can be implemented. In conjunction with the source separation of waste for all households, intensive composting and recycling programmes and effective refurbish and re-use schemes, residual waste can be considered a temporary phenomenon. Whether or not we can achieve zero waste or can only get close, Zero Waste as a policy is proving to be the most effective driver in achieving waste diversion beyond what used to be imagined as maximum limits. Those implementing Zero Waste policies are showing that the only real limits are those imposed by lack of imagination and lack of political will.

Canberra, Australia, has gone from 22% to 66% recovery of waste in six years (93/94 – 99/2000), with no incineration. The success is part of a drive to achieve 'zero waste' by the year 2010 utilising systems designed to separate waste into streams to maximise recycling.

Details:
www.act.gov.au/nowaste/wastestrategy/index.htm

Finances – cutting costs, raising revenues and new external funds

Dramatic improvements in the financial costs/benefits of recycling and composting have been made in the past three years: the net costs of recycling have continued to fall; new external funds have been announced (below); rising landfill taxes have increased the value of recycling credits; and Materials Marketing Consortia have been successfully developed.

External Funds

There is a range of funding coming on-stream that provides a new opportunity for local authorities to invest in recycling:

- £50 million through the New Opportunities Fund
- £140 million through a ring-fenced recycling/composting fund
- £1.127 billion in new Standard Spending Assessment (SSA) funding
- PFI funding in Sept/2000 revised its criteria to prioritise recycling/composting
- Landfill credits (£100 million annually) now target recycling more directly
- SRB (Single Regeneration Budget) -related funding
- The Neighbourhood Renewal Fund (£900 million for 88 Boroughs)
- Social Exclusion Funding
- Market development funds (e.g. the £40 million WRAP programme)
- An annually rising set of PRN targets

These funds offer the UK's local authorities access to a major share in £2 billion to £3 billion over the next three years. By contrast, landfill and incineration face ever rising costs through rising landfill taxes; Parliamentary support for a proposed incineration tax; the end of renewable energy funding, and the tightening of PFI limits on incineration.

The opportunities for local authorities to act now and accelerate their shift toward high recycling and composting systems are clearer than ever before.

Other benefits

When costing changes in waste systems – market sales, recycling credits, external funding and waste systems savings are usually included. However, there are additional important benefits that waste managers should include when making the case within the local authority for investment in new systems:

- Increased recycling employment generates additional financial benefits for the local economy – e.g. adding 50 new collection jobs injects £750,000 into the local community, often more than any increased waste management costs.[8]
- Tangible, visible progress in recycling helps to constructively engage neighbourhoods, estates and businesses – with consequent savings in Council decision-making time by reducing damaging 'Council vs. The Public' battles.
- Quality of life gains include reduced street litter, cleaner neighbourhoods, and, most significantly, the improvement in quality of life on estates.
- Finally, the environmental gains from reducing waste going to landfill and incineration – in energy use, in improved air and water quality, reduced CO2 emissions and in global resource conservation – may provide the greatest benefits of all.

Further information

The Composting Association:
2001 Large Scale Composting: a practical manual for the UK.
1998 A Guide to In-vessel Composting – Plus a Directory of Systems
www.compost.org.uk

Progressive Farming Trust (2000).
Kerbside collection of source separated compostable household waste – a review of methods of encouraging the establishment and expansion
of such schemes. Bulson, H.A.J and Purbrick E.A.
ISBN 1-1872064-31-0

Greenpeace UK 2001:
Achieving Zero Waste
www.greenpeace.org.uk

Waste reduction Programs
www.city.toronto.on.ca/taskforce2000
www.targetzerocanada.org
www.gov.edmonton.ab.ca

Manufacturers/distributors of in-vessel and other composting systems

Alpheco Ltd. Ipswich
tel 01473 730259 fax 01473 730295
alpheco@anglianet.co.uk
www.alpheco.co.uk

Bedminster AB, Sweden
tel +46 8 52 03 59 00.
bedminster@bedminster.se www.bedminster.se

EcoSci Ltd. Exeter.
tel 01392 424846 fax 01392 425302.
Ecosci@mail.zynet.co.uk

Farrington Environmental Ltd. Wells, Somerset.
tel 01749 676969 fax 01749 679915

Plus Grow Environmental Ltd. Manchester.
tel 0161 872 3022 fax 0161 972 9756

Wilkie Recycling Systems, Berks,
tel 0118 981 6588/6330
info@wilkiwrecycling.com

Wright Environmental Management UK Ltd. Belfast.
tel 01232 640972 fax 01232 640976
www.wrightenvironmental.com

Notes

[1]DoE 1995, Making Waste Work.

[2]DETR 2000 ‘Waste Strategy 2000’ part 2, p.191.

[3]See for example EA/LPAC/Ecologica 1998, Re-Inventing Waste: towards a London Waste Strategy, and Robin Murray 1999, Creating Wealth from Waste, Published by Demos.

[4]Biffa, July 2001, PFI Update.

[5]In some circumstances where it is felt that a three bin system is not workable a two bin system can be used. (Dry recycleables in one bin the rest in the second stream, or compostable material in one bin and the rest in the second), followed by mechanical separation before recycling. Edmonton, Canada has reached 70% diversion using two bins. However organic waste collected without source separation is likely to be contaminated to some degree and will have restricted end use applications and a lower market value.

[6]The Composting Association, 2001. Large Scale Composting. A Practical Manual for the UK. p 27.

[7]Re-inventing Waste: Towards a London Waste Strategy. Robin Murray/Ecologica 1998.

[8]See for example Robin Murry “Creating Wealth from Waste” DEMOS (1999).


TOXIC CRIME
CLEANSING
INCINERATOR

‘There is no question that the Landfill Directive can be met by local authorities without mass burn incineration’

Philip Cozens, Major Projects Development Officer, Shanks.

‘It is entirely possible to achieve the Landfill Directive targets without using incineration’

Peter Jones, Director, Biffa Waste Services

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