

Information sheet  
**Sustainable  
household waste  
management**



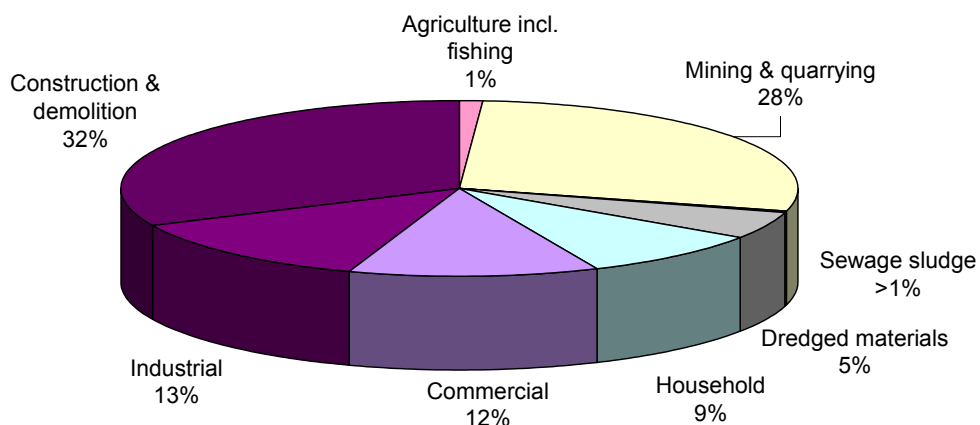
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## Household waste in the UK

Total UK waste arisings are estimated to be almost 317 million tonnes.<sup>1</sup> At approximately 9%, household rubbish is a relatively small percentage of the total amount of waste produced in the UK. Nevertheless, it is a significant proportion because it contains large quantities of organic materials which release potent greenhouse gases such as methane when they decompose. Household waste also includes reusable materials such as glass, metals and plastics.

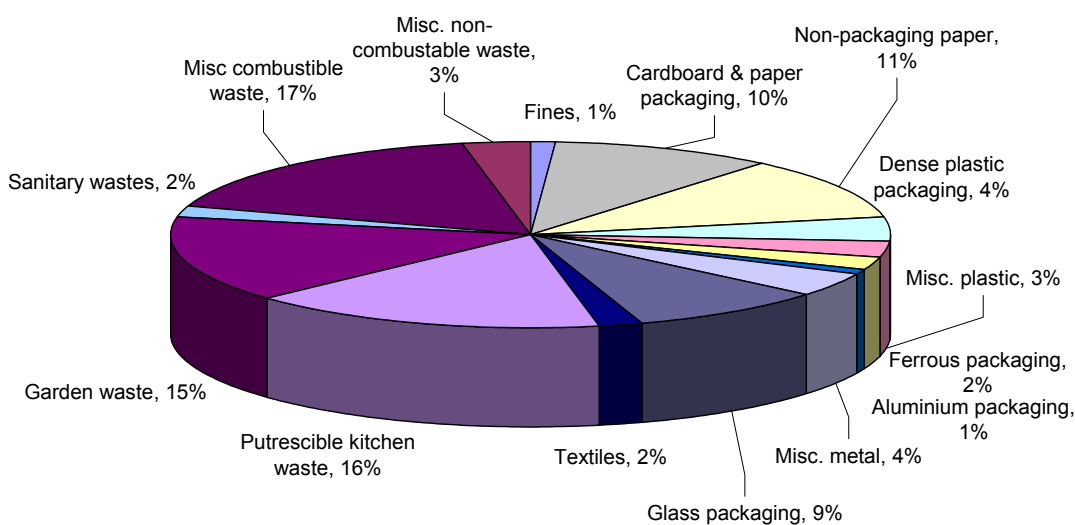
### UK total annual waste arisings by sector, 2004



Source: Defra e-digest

It is estimated that 25.6 million tonnes of household waste was generated in the UK in 2007. That equates to about 509kg, or half a tonne, per person.<sup>2</sup>

### Average household waste composition (by weight) 2007



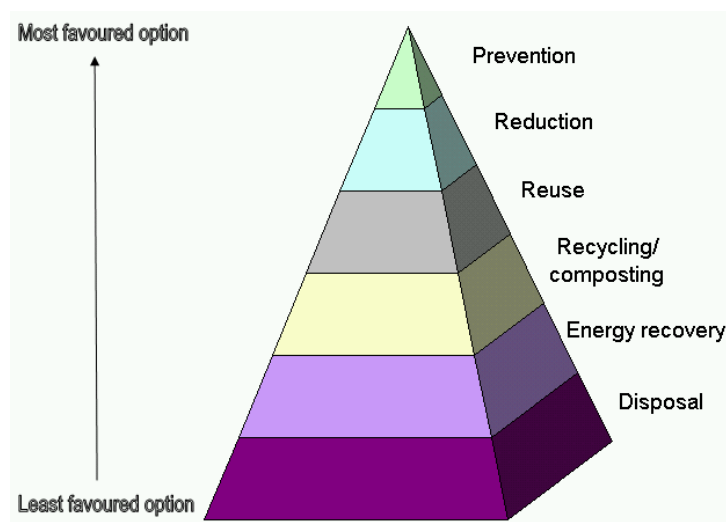
Source: The Open University

## The waste hierarchy

The waste hierarchy is a framework that has become a cornerstone of sustainable waste management. It sets out the order in which options for waste management should be considered based on the environmental impact of each option. The hierarchy encourages the adoption of options for managing waste in the following order of priority:

- Waste should be prevented or minimised at source as far as possible.
- Waste materials should then be recycled or reprocessed into a form that allows them to be reclaimed as a secondary raw material.
- Where useful secondary materials cannot be reclaimed, the energy content of waste should be recovered and used as a substitute for non-renewable energy resources.
- Only if waste cannot be prevented, reclaimed or recovered, should it be disposed of into the environment by landfilling, and this should only be undertaken in a controlled manner.

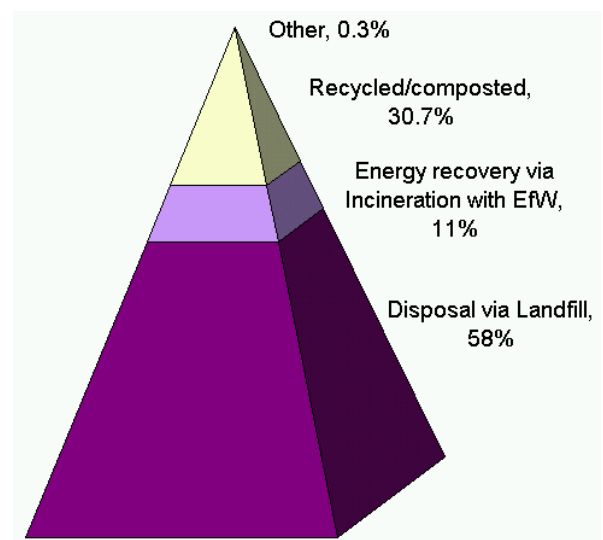
### The waste hierarchy



### Municipal waste management in the UK, 2006/07

Source: Defra e-digest

In the UK, approximately 58 % of municipal waste (which is made up of household waste, schools waste, litter bin contents and street sweepings) was landfilled in 2006/07. A further 11 % was incinerated with energy recovery and 30.7 % of waste underwent recycling.<sup>3</sup> Waste prevention and reduction is difficult to account for because it would amount to recording something that does not exist.



## Prevention and minimisation

At the top of the waste hierarchy sit the two most desirable options – waste prevention and minimisation. In every walk of life, it is best not to produce waste in the first place as this will prevent valuable resources being lost and energy embedded in products and used during manufacturing being wasted. Householders can play a role in preventing waste in making considered purchasing decisions.

**Avoiding the needless waste of food could prevent the equivalent of 18 million tonnes of CO<sub>2</sub> emissions generated every year by producing, storing, transporting and landfilling – that's the same as taking one in five UK cars off the road.**

Source: WRAP

For example, it is estimated that nearly one quarter of the 4.1 million tonnes of avoidable food waste UK households throw away every year is thrown away whole, untouched or unopened. Of this, at least 340,000 tonnes is still in date when thrown away.

A further 1.2 million tonnes is simply left on our plates. Altogether this constitutes a third of the food bought in the UK.

## Reuse

Where waste cannot be prevented, waste materials or products should be reused directly, or refurbished and then reused. Many household items lend themselves to reuse for another purpose. For example, glass jars or plastic containers can be used for storage. Plastic carrier bags can be reused or can be replaced with more durable cloth bags.

The UK has an excellent network of approximately 400 organisations that refurbish and reuse unwanted electrical goods and furniture, which collect and pass on an estimated 2 million items per year to low income families. This diverts 85,000 tonnes of waste from landfill and provides 3,000 people work in the UK to collect and deliver furniture and appliances.<sup>4</sup>

Another example of reuse is returnable plastic crates, which are used by the major supermarkets to transport and display groceries. Using these kinds of crates produces 95 % less total solid waste, 39 % less total energy and 29 % less total greenhouse gas emissions.<sup>5</sup> Returnable crates usually last up to 20 years and can be recycled at the end of their useful life.

## Recycling

Over half of the contents of our household waste bins could potentially be recycled or composted. The term recycling describes the re-processing of used products to provide the raw material to make new ones. There are many benefits to recycling.

Recycling reduces the demand for raw materials. By recovering materials from old products we are removing or reducing the need to extract new raw materials such as ores, timber and crude oil.

**Recycling aluminium can save up to 95% of the energy compared to the production of new aluminium. Every tonne of aluminium drinks cans recycled saves 10 tonnes of CO<sub>2</sub> equivalent.**

Source: Alupro

This is important because the vast majority of raw materials used in manufacturing products and providing services are not renewable – we will eventually run out.

Recycling means that we also avoid many of the environmental impacts associated with extracting the new resources, manufacturing and distributing the goods. Activities such as mining, quarrying and logging can be environmentally and socially destructive, damaging the natural environment and local wildlife habitats. Recycling generally uses less energy and causes less pollution than using raw materials.

Recycling reduces the amount of waste being landfilled or incinerated, which can harm the environment if not properly managed. Most importantly, when rubbish is buried or burned, valuable natural resources are irretrievably lost.

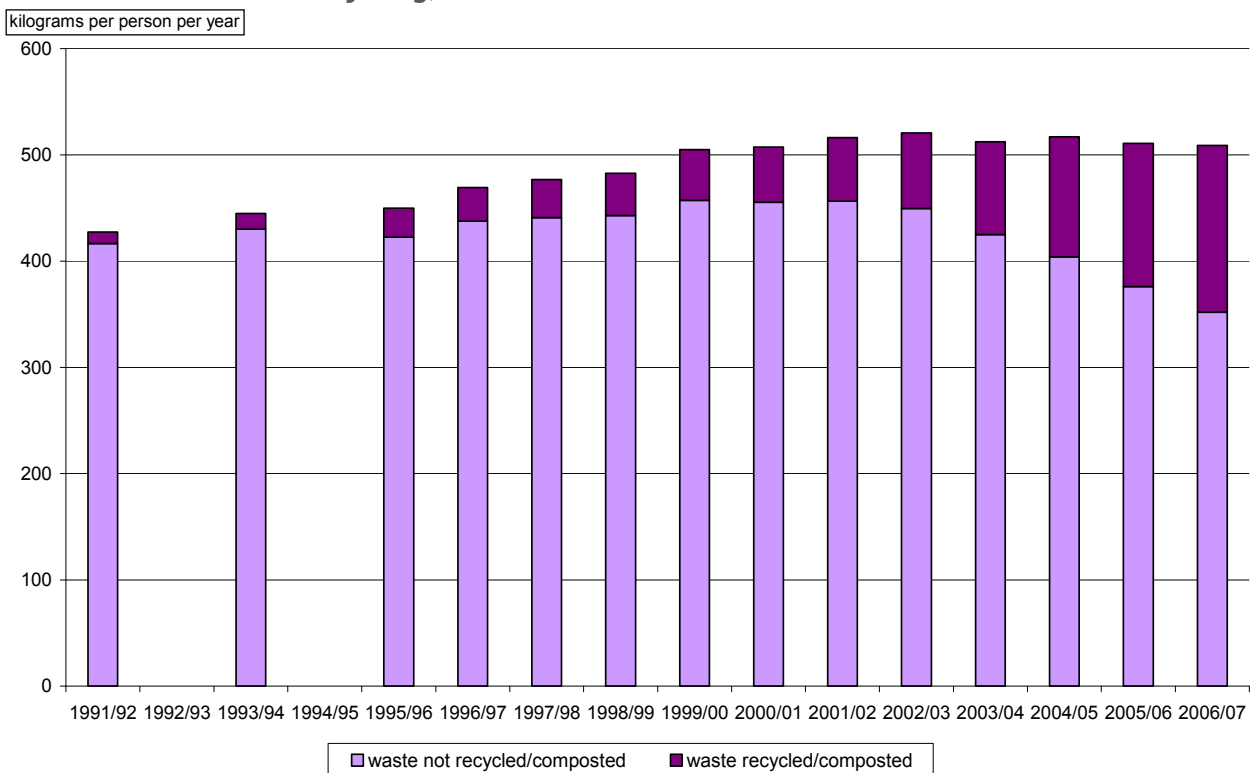
The energy used to recycle plastic bottles is eight times less than the energy required to manufacture the same virgin plastic. For each single bottle recycled, this energy saving is equivalent to the energy needed to light a 60 W bulb for up to 6 hours.

Source: RECOUP

## Household waste recycling collections

The average UK recycling rate is estimated to have risen to 33 % in early 2008<sup>6</sup> and the proportion of household waste recycled has increased steadily over the last decade or so. The average residual household waste produced per head decreased from 353kg per head in 2006/07 to 334 kg per head by the end of 2007.<sup>7</sup>

### Household waste and recycling, 1991/92 – 2006/07



Source: Defra e-digest

This is the result of an increasing number of UK local authorities offering comprehensive kerbside recycling and composting collections and an increasing majority of UK householders who are recycling. In 2005/6, around 94 % of English households were offered a kerbside collection that included at least one recyclable material.<sup>8</sup> Under the Household Waste Recycling Act 2003, all English council are required to provide the separate collection of at least two materials for recycling by the end of 2010.

The UK's current level of recycling of paper and board, glass, plastics, aluminium and steel saves the equivalent of between 10 and 15 million tonnes of CO<sub>2</sub> per year. This is equivalent to about 10 % of the annual CO<sub>2</sub> emissions from the transport sector and amounts to taking 3.5 million cars off UK roads.<sup>9</sup>

## Why do recycling collections vary from council to council?

Waste management arrangements across the UK offer a diverse picture, with waste and recycling schemes tending to differ from local authority to local authority. This has its origin in UK environmental

law. The Environment Protection Act (EPA) 1990 divides local authorities between Waste Collection Authorities (WCAs) and Waste Disposal Authorities (WDAs).

WCAs are charged with the collection of waste from each household in its area on a regular basis. In England, these are the District Councils and Unitary Authorities. WDAs are local authorities charged with providing disposal sites, to which it directs the WCAs for the disposal of household waste, and with providing civic amenity facilities. In England, these are the County Councils and the Unitary Authorities.

Each collection authority can make its own decisions as to the method and frequency of waste collection. As a result, there is a noticeable lack of uniformity and consistency in collection arrangements across the UK, particularly with regard to the materials accepted in kerbside recycling schemes and household waste recycling facilities. Collection providers also vary from in-house or Direct Service Organisations (DSOs) and well-established waste management companies to non-profit social enterprises.

In deciding on the number and types of materials collected, councils have to take into consideration a number of factors, such as likely long-term development of market prices for recyclables, expected capture rates for individual materials and the cost of collection and separation of materials.

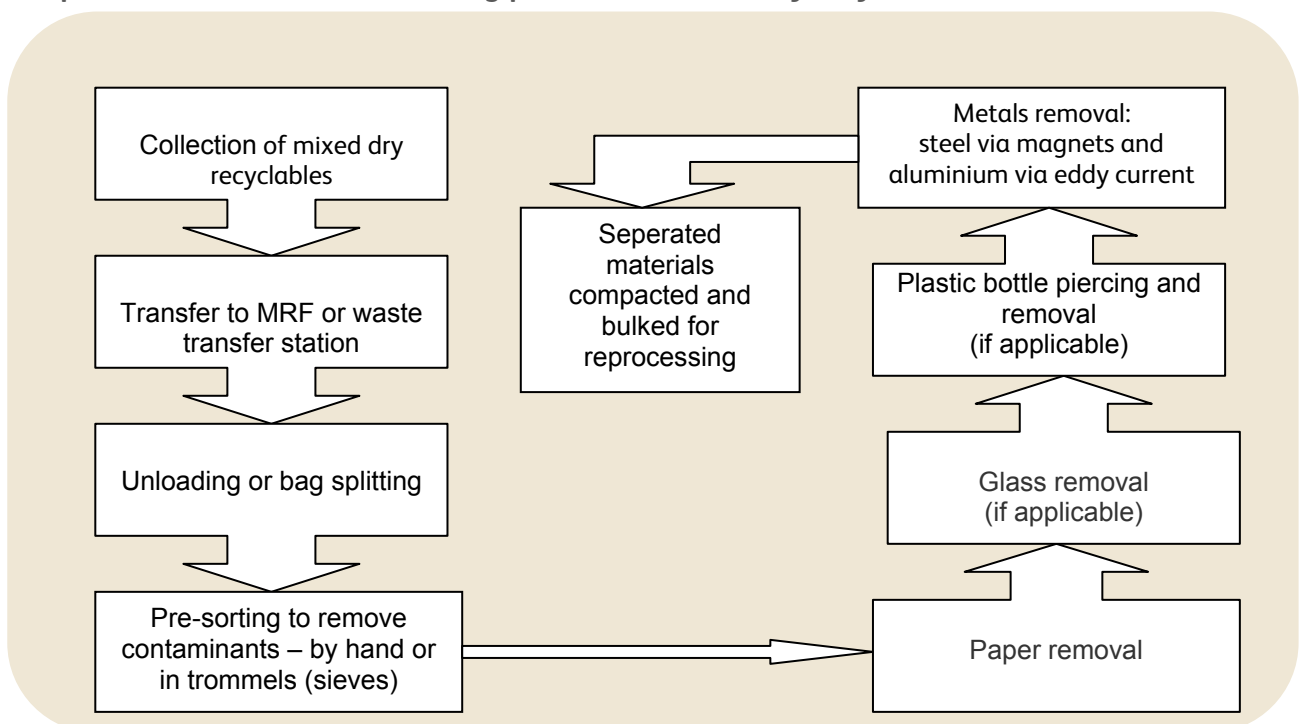
## What happens to the collected material?

### Co-mingled recycling collections

An increasing number of councils have found it more cost-effective to collect recyclable materials through so-called co-mingled collections. This involves all recyclables being deposited in one receptacle such as a plastic sack and being collected, and sometimes compacted together inside the collection vehicle. These mixed materials are taken to a Materials Recycling (or Recovery) Facility (MRF) for sorting.

The simplest sorting techniques at MRFs are manual, employing people to pick out materials from a raised conveyor belt. However, mechanical sorting systems have developed considerably over recent years, and the newer MRFs can automatically separate recyclable materials in the waste stream.

### Simplified MRF mechanised sorting process for mixed dry recyclables



## Source-separated recycling collections

A different type of recycling collection involves the separation of individual materials at source by the householder and / or the collection crew who put the different types of recyclables into separate cages on the collection vehicle. These are referred to as source separated or kerbside-sort schemes.

The segregated materials are bulked up and baled for onward transportation to scrap merchants or directly to reprocessors and then sent to reprocessors such as paper mills, glassmakers or plastic reprocessing plants where they are processed for use in other applications, or are turned back into the same product.

Some materials such as aluminium and glass can be recycled indefinitely, as the process does not affect their structure. Other materials, such as paper, often require a mixture of waste and virgin material to manufacture a new product. Plastics must be separated according to their material type (denoted by a number usually stamped on the product) because the characteristics of each polymer requires a different treatment process. Some plastics are more difficult to recycle than others and only lend themselves to lower grade uses. For example, polystyrene cups cannot currently be turned back into food-grade plastics, but are recycled into pens or key rings.

Recently, there has been some debate about the increase in co-mingled collection schemes because some of the recyclate derived from these does not lend itself to closed-looped recycling. For example, to be recycled back into bottles and jars, the different glass colours need to be kept separate throughout the recycling process. Co-mingled systems do not allow for this and, as a result, glass from these collections is diverted to other uses such as aggregate for road building. In 2007, cullet for bottle recycling decreased by 56,000 tonnes from 2006, despite a significant increase in the amount of glass recovered for recycling, leaving the British glass industry short of a vital local raw material source.<sup>10</sup>

## Compulsory recycling and variable charging

A growing number of councils are also introducing compulsory recycling schemes with the possibility of fining residents who do not use the recycling service provided. Some councils have also provided householders with smaller general waste bins and will not collect any additional rubbish put out. The aim of these kinds of initiative are to encourage people to separate more of the materials that councils collect for recycling and thereby reduce the amount of residual waste that needs to be disposed of through landfill or incineration.

Existing legislation in the UK forbids any sort of charge to be made for household waste collection but the previous government's UK Waste Strategy 2007 suggested provision be made for pilot schemes involving variable charging for residual waste collections, so-called Pay As You Throw (PAYT) schemes. PAYT refers to the application of a financial fee for the collection, treatment and disposal of waste produced by households. Crucially, it is charged according to the quantity of waste set out.

There are a number of ways in which the amount of waste can be measured: by volume, by weight and by the size or number of containers, or a combination of these. Such schemes have been in operation in the US and continental Europe for some time and research<sup>11</sup> has shown that the introduction of such schemes helps reduce residual waste arisings by encouraging recycling and waste reduction. Such schemes go beyond recycling in that they also influence householders' shopping habits and promote waste prevention at source as householders seek to reduce the amount of waste requiring collection and disposal.

## Composting of biodegradable waste

The diversion of biodegradable municipal waste (BMW) from landfill is a key objective under the European Union Landfill Directive. BMW includes food and garden waste, paper, card and other organic

material. In 2006/07, almost 3 million<sup>12</sup> tonnes of household waste was collected by local authorities for composting, out of the nearly 7 million<sup>13</sup> of kitchen and garden waste produced annually in England.<sup>14</sup>

## Composting

Also known as aerobic digestion, composting is a process whereby biodegradable wastes decompose in the presence of oxygen from the air, as a result of the action of micro-organisms. The stabilised residue, or compost, can then be used as a growing medium, soil conditioner or mulch, depending on its quality. Compost from source-segregated waste tends to be of a better quality than compost from mixed garden and kitchen waste as it is submitted to stricter compost use rules, due to the potential health risk of diseases from meat wastes. The process produces high temperatures (especially in commercial composting) and releases carbon dioxide, a greenhouse gas, but the amounts produced are considered biogenic, i.e. it is equivalent to the amount absorbed by the plant matter when it was growing.<sup>15</sup>

## Anaerobic digestion

This is a process in which biodegradable waste is decomposed in the absence of oxygen to produce biogas (methane and some carbon dioxide) which can be used as a renewable energy source for heat and power, and as a transport fuel. It also produces a nutrient-rich digestate which can be used as fertiliser. This method is particularly suited to treat source segregated food waste being diverted from landfill. A large-scale plant opened in Shropshire in 2007 with support from the £30 million New Technologies Demonstrator Programme which tests innovative technology that could offer alternatives to landfill. If exploited to its full potential, it is thought anaerobic digestion plants could eventually produce enough electricity to power two million UK homes.

## Energy recovery – incineration with energy from waste

Where recyclable materials cannot be reclaimed as a raw material source, their energy content should be recovered and used as a substitute for non-renewable energy resources.

Energy can be recovered from waste either by direct waste incineration, which typically involves incineration plants processing unsorted waste and generating electricity, or by turning waste into a fuel substitute, called refuse derived fuel (RDF).

With around 11 % of municipal waste being used for energy recovery,<sup>16</sup> incineration is not as widely used in the UK as in some other countries. By comparison, countries like Denmark, dispose of over 50 % of waste through energy from waste (EfW) plants.<sup>17</sup>

Despite improvements in the operation of incinerators as a result of European Union legislation, there is still considerable public concern about potential health effects. The by-products of the incineration process may contain hazardous or toxic pollutants and emissions can contribute to background pollution levels. Since 1996 there have been significant cuts in emissions from incinerators in order to meet strict European Union legislation. This has led to the phasing out of the older, more polluting plants as new emission and operation standards were introduced. As a result, contemporary facilities are substantially less polluting and modern abatement technology will help reduce the hazard from emissions provided that the facilities are properly operated at all times.

In addition, the 2000 European Union Waste Incineration Directive was transposed into UK law in 2002 and all new and existing incinerators have to comply with the tighter provisions of this directive, which aims to reduce and / or prevent possible negative effects on the environment and the risks which these pose to human health. Compliance will mean further significant reductions in the emissions of key air pollutants such as nitrogen oxides, sulphur dioxide and hydrogen chloride, as well as dioxins and furans.<sup>18</sup>

From a resource efficiency perspective, incineration may not be the best way to deal with our rubbish, as even if energy is obtained through the process, burning waste will result in the irretrievable loss of potentially reusable resources.

## Disposal

The majority of UK waste is still being disposed of through landfill, although this has been decreasing rapidly in recent years due to inroads made in recycling and energy recovery. It is estimated that in 2006/07, 58 % of the total waste produced was sent to landfill<sup>19</sup> and 65 million tonnes of waste were sent to landfill in 2006.<sup>20</sup>

Historically, the UK has favoured landfill for disposing of rubbish, and this has been made easier because of the UK's geology. Mining and quarrying have left large holes in the ground which were restored by filling with waste. In addition, the underlying geology often provided naturally impermeable ground conditions, allowing us to bury our waste with less risk of potentially harmful liquids seeping out and polluting groundwater. The consequence of this was that landfilling was relatively cheap.

Poorly managed sites have resulted in polluted ground or surface waters and uncontrolled landfill gas generation. Without proper control, landfills can be a nuisance to neighbours in the form of odours, flies, litter or noise in the surrounding area. Modern landfills typically involving lining and capping individual cells or compartments into which waste is compacted and covered to prevent the escape of polluting liquid or gases.

In newer landfill sites, systems are installed to capture and remove the gases (landfill gas) and liquids (leachate) produced by the decomposing rubbish.

Many current landfill sites are nearly full and the UK is rapidly running out of suitable land, close to where the waste is produced, for new landfills. To incentivise the adoption of more sustainable waste management options such as recycling, waste going to landfill has been subject to the Landfill Tax since 1996. Since its introduction, the tax has been increased year on year, gradually reducing the perceived cost-benefit of landfilling and providing funding for alternative waste treatment options. In 2008, the Landfill Tax rate for active waste increased to £32 per tonne and will go up by £8/year to £48/tonne until at least 2010.<sup>21</sup>

There is increasing concern about greenhouse gas emissions (which contribute to climate change) from landfills, especially methane. One tonne of biodegradable waste produces between 200 and 400 m<sup>3</sup> of landfill gas. Landfills released 40 % of the UK's methane emissions in 2003, accounting for about 3 % of all of the UK's greenhouse gas emissions.<sup>22</sup>

The European Union Landfill Directive addresses this concern, and under the directive, the UK is obligated to reduce the landfilling of biodegradable waste to:

- 75 % of 1995 levels by 2010
- 50 % of 1995 levels by 2013
- 35 % of 1995 levels by 2020

## New waste management technologies

Materials may also be recovered using new technologies, which do not require separate collection. These include.<sup>23</sup>

**Mechanical Biological Treatment (MBT):** MBT facilities were developed with the aim of pre-treating and thereby reducing the environmental impact of landfilling residual waste. They can also be used to separate recyclable materials such as plastic from unsorted household waste. MBT involves mechanical processes to extract recyclables, followed by biological processes to recover the organic fraction. A proportion of the waste treated through MBT will be used to produce Refuse Derived Fuel (RDF) whereby only its energy value is recovered. MBT and other mechanical sorting methods will always result in some contamination of the different waste fractions and consequently the recyclables extracted are likely to be lower in quantity and quality than those collected through a source segregated collection. As a result, they may not be returned into closed-loop recycling systems such as those that exist for glass and paper.

**Mechanical Heat Treatment (MHT) including Thermal Autoclave:** These treatment processes involve mechanical and thermal (including steam) technologies which are used to separate mixed waste into several component streams. Autoclaving, for example, treats waste with steam. During this process, plastics are softened (some types forming dense balls) and labels removed. The resulting fibre, or floc, is said to be suitable for recycling into construction products or can be used as RDF. A limited commercial track record for these kinds of processes currently cast a doubt on end markets or outlets for the outputs.

**Thermal Treatment including incineration, pyrolysis and gasification:** Incineration (also referred to as Energy from Waste) involves the combustion of untreated waste or RDF with recovery of energy in the form of electricity and / or heat. Pyrolysis and gasification are similar heat treatment processes, albeit operating at different heat settings, whereby organic derived materials in the waste, such as plastics and paper, are broken down in the absence of oxygen. Both processes produce a gas known syngas, which can be used to generate electricity or to power engines. All these processes differ from recycling in that they only recover the embedded energy, but do not allow a further use as a raw material.

## Contacts

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| <b>Freegle</b><br>Website: <a href="http://www.freegle.org.uk">www.freegle.org.uk</a><br>Local online communities where people can donate and receive unwanted items for free and divert them from landfills.  | <b>Recycled Products Guide</b><br>Website: <a href="http://www.recycledproducts.org.uk">www.recycledproducts.org.uk</a><br>The Recycled Products Guide is administered by the Waste & Resources Action Programme (WRAP).   |

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