

PLASTICS RECYCLING

Plastics Waste Arisings and Recycling Rates

There are a number of plastic types or polymers. The polymer type dictates both the properties and characteristics of the material and its suitability for subsequent recycling. The main types of polymers and some typical uses are listed below:

Polymer Type	Typical Uses
Polyethylene Terephthalate (PET)	• soft drinks bottles
High Density Polyethylene (HDPE)	• blow moulded packaging such as milk bottles & drums • injection mouldings such as food trays • extrusions such as pipes and guttering
Low Density Polyethylene (LDPE)	
Linear Low Density Polyethylene (LLDPE)	• carrier bags and films
Polyethylene Film (PE Film)	• pallet shrink wrap, plastics bags and sacks • agricultural silage wrap
Polypropylene (PP)	• textile applications such as carpets, cords and ropes • moulded applications such as rigid crates and car components
Polystyrene (PS)	• thin sheets are used to make margarine tubs and dairy food cartons • expanded polystyrene is used mainly in packaging
Poly Vinyl Chloride (PVC)	• flexible PVC is used for wire & cable coatings and floor coverings, packaging and healthcare applications, e.g. blood bags • rigid PVC is used in pipes, guttering and window frames

The Association of Plastics Manufacturers in Europe (APME) has estimated the consumption of plastics by sector in Europe as follows:

Plastics Consumption by Sector

Sector	Million Tonnes	%
Packaging	13.72	37.3
Building & Construction	6.94	18.9
Electrical & Electronic	2.67	7.3
Automotive	2.65	7.2
Other Household/Domestic	7.83	21.3
Large Industry	1.99	5.4
Agriculture	0.96	2.6
Total	36.769	100

The UK uses around 5 million tonnes of plastic per year and it is estimated that around 2.8 million tonnes of plastics arises in the UK waste stream each year.

A high percentage is plastics packaging which is generally considered to have a short-life, i.e. the time between use and disposal is short. In 2000, businesses obligated under the UK's Packaging Regulations reported 1,583,803 tonnes of plastic packaging, of which 204,430 tonnes was recycled either in the UK or abroad, approximately 13%. Data for 2001 suggest this has increased to approximately 16% of plastic packaging waste.

The automotive and electrical and electronic equipment waste streams, which both include long-life applications for plastics, are the subject of proposed environmental legislation and will become a focus of recycling.

Plastics Recycling Operations

The latest figures from the British Plastics Federation (BPF) estimate that in total around 218,000 tonnes of post-use plastics were recycled in 1999 in the UK. Post-use plastics have been used at least once prior to being reclaimed. This excludes process scrap which arises from plastic manufacturing processes. Around 95% of process scrap is recovered 'in house' and so does not contribute significantly to the waste stream.

There are two methods of recycling plastics, mechanical recycling and feedstock, or chemical, recycling.

Mechanical recycling is primarily a method of treating single polymer waste. The waste is converted into pellets or granules for extrusion into new products. This allows the addition of virgin polymer materials, pigments and stabilisers. Most plastic recycling companies in the UK operate this type of process. Plastic recycling companies of this kind are often small to medium sized enterprises, typically with a capacity of 5,000 to 20,000 tonnes per annum.

Feedstock recycling is a relatively new recycling technology which can be used to treat mixed polymer waste. The method used depends on the nature of the waste. For example, thermolysis is used to convert mixed plastic wastes back into the component monomers. Feedstock recycling plants can handle relatively high tonnages of plastics and require major capital investment. The UK does not operate any full-scale feedstock recycling plants, although BP Chemicals in Grangemouth has carried out some pilot plant studies into the technology. Capital investment requirements into feedstock recycling methods are much higher than requirements for mechanical recycling plants.

Technical and Economic Barriers to Recycling Plastics

In-house recycling of plastics process waste is carried out extensively. As such, this waste never reaches the commercial or domestic waste stream. It makes financial sense to recycle this waste as it is available in large quantities, contaminant-free, consists of a single, identified polymer type and there is a demand for the 'recycled' product.

There are a number of barriers to increasing the levels of post-use plastic recycling in the UK. These barriers are inter-linked and include:

Collection Costs

Commercial and, in particular, domestic plastic waste arisings are found in diverse locations in low volumes. The cost associated with collection from the point at which the waste arises and transportation to a recycling facility can often be prohibitive.

Contamination of Waste Plastics

Plastic waste for recycling needs to be free of contamination. Household plastic waste is often mixed with other household waste such as paper, metals and food waste. To ensure that the plastic is suitable for recycling this type of waste needs to be sorted and cleaned prior to processing.

As plastic waste recycling in the UK is mainly suitable for single polymer waste streams, the feedstock material must consist of single polymer. There are additional costs associated with identifying and sorting the waste by polymer type.

Markets for Recycled Polymers

Once the polymer has been recycled there needs to be sufficient demand for the recycled plastics. There are no recognised standards for recycled plastics and users are often reluctant to switch to recycled polymer due to concerns about the quality and consistency of supply. Recycled polymers are subject to odour contamination and there are concerns about using recycled plastics in food applications, due to possible migration of contaminants into food products.

Prices for Recycled Polymers

In order for recycling of waste plastic to make economic sense the cost of collecting, sorting, cleaning and reprocessing waste plastic into new materials has to be favourable compared to the costs of using virgin material.

For example, the price of virgin LLDPE pellets averages around £450/tonne, whereas the price of recycled polymer pellets varies depending on the original waste polymer. Prices paid for clean LLDPE process scrap are around £200-280/tonne and the cost of treating this polymer is around £200/tonne. Therefore, recycled LLDPE pellets, manufactured from process scrap, can compete with virgin pellets. However, the cost of treating post-consumer polymer waste is around £400/tonne, which excludes the cost of collection and any price paid for the waste polymer. The cost of collecting and processing often makes recycling of post-consumer polymer waste uncompetitive.

Industry Initiatives

There are various factors which are helping to improve the collection and recycling rate of post-consumer plastics waste, including the Packaging Waste Regulations (see below).

Recycling of Used Plastic Containers Ltd (RECOUP) is the national organisation for domestic plastic recycling. RECOUP focuses on improving the collection and recycling of rigid plastic bottles. In 2001, RECOUP estimated that 238 UK local authorities operated a plastic bottle collection scheme and that 14,770 tonnes of bottles were collected, a 16% increase on 2000 figures.

The Consortium for Automotive Recycling (CARE) is developing a series of material specifications aimed at developing the usage of recycled material in the automotive sector. CARE hopes that all motor manufacturers will adopt and endorse the specifications as being the standard for recycled grades of plastics.

Government Initiatives & Legislation

Packaging Waste Regulations

The EC Directive on Packaging and Packaging Waste is implemented in the UK through the Producer Responsibility Obligations (Packaging Waste) Regulations. The Directive required the UK to meet various objectives including the recovery of 50% of all packaging waste with a minimum recycling target of 15% recycling of individual materials, including plastics, by 2001. The Directive targets are currently being reviewed and are likely to be increased. The UK Regulations have placed obligations on certain businesses in the packaging chain to ensure the recovery and recycling of packaging waste.

Accredited reprocessors of packaging are able to issue Packaging Waste Recovery Notes (PRNs) as evidence that recovery/recycling of packaging waste has taken place. Revenue from the sale of

PRNs can be reinvested in recycling, for example in improving collection schemes.

Government Programmes

The *Waste and Resources Action Programme (WRAP)* was established in 2001 to promote sustainable waste management. WRAP's particular focus is creating stable and efficient markets for recycled materials and products.

WRAP runs a specific programme on plastic waste. This programme sets targets to:

- ▶ increase mixed plastics reprocessing by 20,000 tonnes;
- ▶ increase the recycled content of plastic products;
- ▶ identify methods to produce composite materials from waste plastics and wood or rubber; and
- ▶ significantly increase plastic bottle recycling.

WRAP has set specific aims and actions which are being met through various projects and initiatives.

Further Contacts

Government Contacts

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Further Reading

Survey 2002, Plastic Recycling Report
Recoup, 2002.

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