

Market Situation Report – Autumn 2007

Realising the value of recovered plastics



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

This report looks at the key factors influencing the market for recovered plastics over the past year or so, including domestic and overseas developments; movements in prices; and the environmental benefits from recycling plastics.

In addition, the special report looks in detail at the relationship between the virgin and recovered plastics markets.

Key themes to emerge from the plastics recycling sector in 2006/07 are:

- the volatile prices for recovered plastics, which in part reflect fluctuations in virgin polymer and energy prices;
- the continued growth in exports of recovered plastics (mostly to China), which grew nine-fold between 2000 and 2006;
- the challenge of maintaining quality as a growing volume of material is recovered from post-consumer sources.

Did you know?

22%

22% of plastic packaging consumed in the UK is collected for recycling.

684,000

684,000 tonnes of CO₂ emissions were saved by recycling the UK's plastics in 2006, the equivalent of taking more than 216,000 cars off the road.

£

Typical prices of recovered plastic bottles (as at November 2007):

Clear PET:

£110-£150 per tonne

Coloured PET:

£60-£90 per tonne

Natural HDPE:

£210-£230 per tonne

Mixed colour HDPE:

£140-£180

Mixed polymer bottles:

£85-£110 per tonne

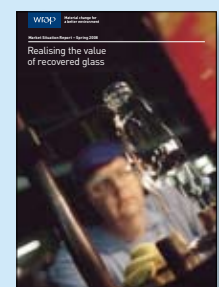
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Organics Winter 2007/08

Glass Spring 2008



Market analysis

Plastics consumption in the UK

UK consumption of plastics is estimated to be over 5 million tonnes per annum, with consumption believed to be growing at about 1½ per cent per year. Around one third of the plastic consumed in the UK is plastic packaging, while construction products account for a further quarter. As data from the British Plastics Federation (BPF) show (Graph 1), plastics are used in a myriad of other applications.

There are many different types of plastics, each with differing chemical compositions and physical properties. However, three quarters of the plastics consumed in the UK fall into one of six main types (Graph 2). Table 1 provides more information about the main polymer types, their applications and how to identify them.

The main plastics used in packaging manufacture are L/LDPE, PET, HDPE and polypropylene. Bags and film, which account for almost 40 per cent of the packaging manufactured in the UK by weight, are primarily made from L/LDPE and HDPE (Graph 3). PET and HDPE, which together account for a further 30 per cent, are the main polymers used for bottles and are used in a variety of other applications (for example, food trays). Polypropylene (15 per cent) is used for both film and rigid applications (such as margarine tubs).

Plastics manufacturing in the UK

The total turnover of UK plastic product manufacturers was estimated to be £18 billion in 2005. This was 6 per cent higher than the previous year and 11 per cent higher than in 2000.

Business conditions for UK plastic product manufacturers have become more challenging in recent years. Sharp price increases in virgin and recovered plastics, and rising energy costs, have led to higher input prices. However, plastics manufacturers' ability to pass on their higher costs has been constrained by limited pricing power and domestic and overseas competition. As a result, margins have been squeezed (Graph 4), and the lag between passing on higher input prices to output prices is reported

to have intensified the pressure. In response, many UK plastic product manufacturers have moved their production facilities to lower cost economies. Furthermore, overcapacity in the UK and the rest of Europe has heightened interest from private equity groups and increased prospects for merger and acquisition activity.

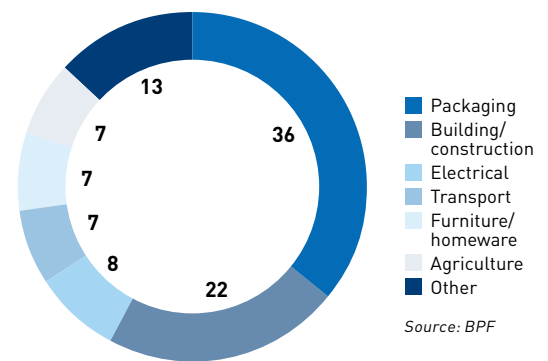
Plastics recovery in the UK

The vast majority of the post-use plastics recovered from the UK waste stream are packaging plastics. This reflects regulatory drivers such as the Packaging Directive and also the fact that packaging has a very short lifespan compared with other applications and comprises a larger proportion of the plastics waste stream than suggested by the consumption data. Accordingly, this report focuses primarily on the recycling of packaging plastics.

Defra data suggest that during the first three quarters of 2007, around 22 per cent of plastic packaging was recycled in the UK. Although this represents an increase in the recycling rate of only 3 percentage points since 2003, the growth in the waste stream during this period means that the volume of material recovered has increased by over 40 per cent to around 470,000 tonnes. To meet the current target of a 24 per cent recycling rate by 2010 will require a further 70,000 tonnes of material to be recovered per annum.

The recycling rate for plastic packaging is lower than that for other materials, such as paper and glass. This reflects the relative difficulty of collecting, sorting and processing plastics due to their low density, the high likelihood of contamination (particularly for plastics recovered from the municipal waste stream) and the wide range of polymer types. However, it also suggests that there may be scope to considerably improve recycling rates, especially given the high value of recovered polymers relative to other dry recyclables (see Prices, page 5).

Graph 1: End markets of plastic products manufactured in the UK (by weight), 2005



Graph 2: Types of plastic used in the UK (all applications, by weight), 2005

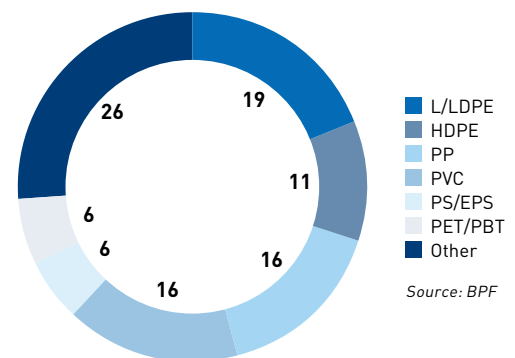
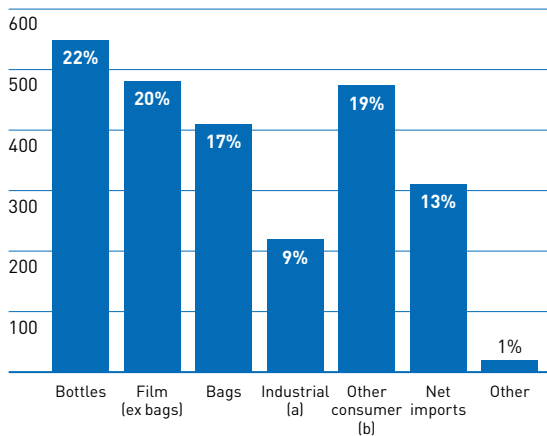


Table 1: Main polymer types and their applications

Polymer types	Product examples	Symbol
Polyethylene terephthalate (PET)	Fizzy drink and water bottles, salad trays	PET
High density polyethylene (HDPE)	Milk bottles, bleach, cleaners and most shampoo bottles	HDPE
Polyvinyl chloride (PVC)	Pipes, fittings, window and door frames (rigid PVC). Thermal insulation (PVC foam) and automotive parts	PVC
(Linear) low density polyethylene (L/LDPE)	Carrier bags, bin liners and packaging films	LDPE
Polypropylene (PP)	Margarine tubs, microwaveable meal trays, fibres and filaments for carpets, wall coverings and vehicle upholstery	PP
Polystyrene (PS)	Yoghurt pots, foam burger boxes and egg cartons, plastic cutlery, packaging for electronic goods and toys, insulation	PS
Others	Any other plastics that do not fall into any of the above categories – eg polycarbonate (used for CD cases and car headlights)	07-19

Graph 3: UK plastics packaging by application

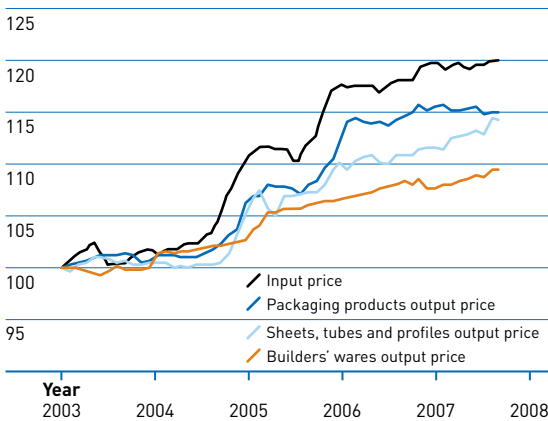
thousand tonnes



a) e.g. transit EPS, strapping, crates, pallets, pails and drums.
 b) e.g. closures, semi-rigid and thermoformed packs and trays.
 Source: Recoup

Graph 4: Plastics manufacturing input and output prices

January 2003 = 100



Source: ONS Producer Price Indices.

Table 2: Plastics recovered from the municipal waste stream (2005/06)

thousand tonnes

Region	Kerbside	Bring/CA sites	Other	Total MSW
England	67	17	1	85
Wales	6	2	1	9
Scotland	5	3	0	8
Northern Ireland	7	1	0	8
Total UK	85	23	2	110

Note: 'Other' includes municipal collections of commercial, industrial and other non-household waste. Data include an assumed plastics fraction from co-mingled collections.

Sources: WasteDataFlow, SEPA Local Authority Waste Arisings Survey and WRAP estimates.

Table 3: Trends in plastics collections in England

thousand tonnes

Collection type	2003/04	2005/06
Kerbside	30	67
of which co-mingled	22	45
Bring/CA	10	17
Other	0	1
Total	40	85
	75%	79%
	55%	53%
	25%	20%
	0%	2%
	100%	100%

Sources: Defra and WRAP estimates.

The Defra data, which are based on packaging recovery notes (PRNs) issued for recycled packaging, may understate the level of plastic packaging recycled. It is likely that additional packaging plastics are recovered by reprocessors and exporters that are not eligible to receive PRNs. And it is possible that the amount of plastics recycled without a PRN has increased over the past year. The number of accredited plastics reprocessors and exporters fell by almost a quarter in 2007, possibly because low PRN prices and higher regulatory costs have not made it worthwhile to seek accreditation.

The available data on the types of plastics recovered suggest that about 40 per cent of packaging plastics recycled are plastic films. The majority of these plastics are recovered from commercial companies – particularly those involved in wholesale and distribution activities – rather than from the municipal waste stream. A further 20 per cent are bottles, and around 10 per cent are believed to be transit and secondary packaging (e.g. pallets and trays). The identity of the rest is unknown, though it is believed to be predominantly plastic film.

Plastic packaging is estimated to comprise around 8 per cent of the household waste stream. However, as recycling rates for other materials increase and because plastic packaging is quite bulky, it is becoming an increasingly visible fraction. Accordingly, local authorities are under increasing pressure to add plastics collections. In 2006/07, more than 90 per cent of local authorities operated plastics collection schemes (some of whom offered only bring schemes), compared with less than three quarters two years earlier. Of those local authorities that collect plastics, most collect only plastic bottles. But the proportion offering mixed plastics collections, which currently stands at almost one fifth, is increasing.

Local authorities recovered around 110,000 thousand tonnes of plastics in 2005/06 (Table 2). The vast majority of this was plastic bottles. More recent data suggest that collection volumes continue to grow rapidly. By end 2006, local authority bottle collections were running at an annualised rate of around 130,000 tonnes per annum.¹

Data for England suggest that the proportion of plastics collected via kerbside collection has increased over

the past two years, but that the proportion of plastics being collected co-mingled with other materials has remained broadly constant (Table 3). The available data suggest that bottles collected from local authorities are broadly evenly split between HDPE (predominantly milk bottles) and PET (fizzy drink bottles).

Regulatory drivers have also led to increases in the recovery of certain non-packaging plastics in recent years. It is estimated that end-of-life vehicles (ELV) and waste electronic and electrical equipment (WEEE) respectively contribute around 200,000 tonnes and 250,000 tonnes per annum of plastics to the UK waste stream. Around 35,000 tonnes of ELV plastics are currently recovered per annum, while up to 75,000 tonnes per annum of WEEE plastics are recovered. Around 70-80 per cent of plastics recovered from ELV are in the form of polyolefins, while those from WEEE are predominantly different forms of styrene.

Recycling the UK's recovered plastics

The most common route for recycling recovered plastic is for it to be used in a different application from the source product. This is known as 'open-loop' recycling, although 'closed-loop' technologies – such as bottle-to-bottle recycling – are gradually being developed. The main end products for recycled HDPE include pipes, pots, crates and other moulded products, while recovered film is turned into sacks, bags and damp-proof membranes. The vast majority of recovered PET (rPET) is used in the polyester fibre industry, although there is growing demand for rPET for closed-loop packaging.

The UK's rigid plastic recycling capacity is estimated to be around 100,000 tonnes per annum. And it is estimated that 250,000 tonnes of plastic film were reprocessed in the UK during 2006. These data include both post-industrial scrap and post-consumer plastics, and both packaging and non-packaging plastics. The UK does not have any polyester fibre manufacturing capacity, so PET bottles destined for the fibre industry have to be exported. New capacity expected to become operational over the next year will increase the UK's bottle processing capacity to 70,000 tonnes per annum. This includes bottle-to-bottle PET and HDPE recycling facilities and is expected to divert material from export.² Due to a lack of domestic capacity, the majority of mixed plastics are exported for reprocessing. Market contacts suggest that up to 15,000 tonnes per annum of WEEE plastics are currently processed for recycling in the UK.

Around two thirds of the packaging plastics recovered from the UK waste stream are exported for recycling overseas, predominantly in China. Exports of recovered packaging plastics have almost tripled over the past three years. This growth in exports has coincided with an apparent 20 per cent fall in the quantity of plastic reprocessed in the UK (Graph 5). Total exports of recovered plastics – including non-packaging plastics and any packaging plastics exported without a PRN – have also grown strongly in recent years (Graph 6).

The growth in exports of recovered plastics largely reflects strong demand from China, where manufacturers' demand for polymers has grown at an average annual rate of almost 20 per cent over the past few years. Chinese domestic virgin polymer production and imports of both virgin and recovered polymers have all risen sharply to meet this demand. The following section explores in more detail the economic rationale and the risks associated with exporting recovered plastics to China.

Export markets for recovered plastics

Between 2000 and 2006, the UK's exports of recovered plastics grew almost nine-fold, from around 50,000 tonnes, of which 80-90 per cent are destined for China. Over the same period, Chinese imports of recovered plastic tripled from around 2 million tonnes to 6 million tonnes.³ Anecdotal evidence suggests that Chinese imports of recovered plastic material may be up to 25 per cent higher than official figures.

The established route for exporting plastics from the UK into China is via Hong Kong. But the proportion of material that is exported directly to China appears to be increasing (Graph 6). Market contacts suggest that it is now possible to achieve higher prices by selling directly into China instead of via Hong Kong, because of the proximity to the end customer. In addition, the customs duties are reported to be significantly lower: around £75 per tonne via China versus £110 per tonne via Hong Kong. This change also stems from Chinese buyers seeking to increase trade and develop better commercial relationships with exporters.

The majority of the recovered plastic packaging exported from the UK to China is PET, HDPE and L/LDPE. Almost all the PET is used to make staple PET fibre, although a small amount is used for other applications including bottle-to-bottle recycling (mostly into non-food grade bottles). The HDPE and L/LDPE are made into a wide range of general purpose

products including household containers, crates, non-food grade bottles and films.

The UK's dependence on export markets has, in part, emerged due to the ability and willingness of Chinese reproprocessors to pay more for recovered plastics than their UK counterparts. This, in turn, stems from the lower cost base – and, in particular, low labour costs – in China. Cheap reverse-haulage shipping, which is a consequence of the trade imbalance between China and Western Europe, has also played a key role.

However, a number of events during 2007 have eroded the financial benefits and highlighted the possible risks of depending heavily on export markets.

Shipping rates have increased sharply over the year to date. Due to a combination of higher fuel prices and higher tariffs, ocean freight rates are estimated to have risen by over 50 per cent to around £15 per tonne. Inland freight tariffs are also reported to have increased. These increases caused some temporary dislocation in export markets and delays to shipments in October, with market contacts indicating that film exporters were particularly affected, although activity was reported to have recovered by the end of the month.

Further disruption occurred when the export of recovered plastics to China was mistakenly prohibited when the EU Waste Shipments Regulation came into force in July. The uncertainty surrounding the regulation caused a drop in exports of recovered plastics from the UK in July, although volumes appeared to bounce back in August.

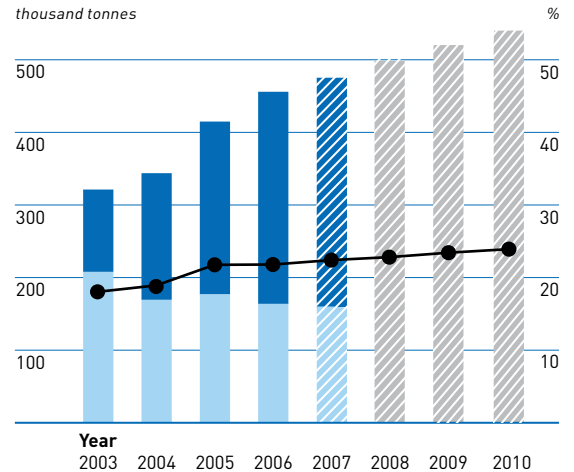
A further risk comes from changes to import restrictions and duties. Chinese law requires recovered plastics to be clean and processed before they are imported, but the application of these standards varies widely. In recent months, Chinese authorities have reportedly tightened import controls on recovered materials. Although this does not appear to have had a material impact on the market to date, a severe clampdown, such as happened in Nanhai in 2005, could partially close the Chinese market to UK material for an extended period.

¹ Source: 'Annual local authorities plastics collection survey 2007', Recoup.

² For example, WRAP is supporting a large scale HDPE milk bottle recycling facility in which the end product will contain 30 per cent recycled HDPE.

³ Source: China Customs Statistics Information Centre.

Graph 5: Plastic packaging recovery and recycling



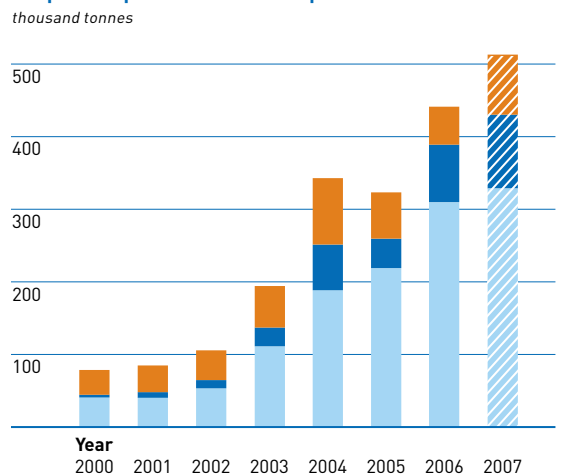
2007 data annualised from data for Q1-Q3.

2008-10 data based on Defra targets.

Source: Defra.

■ Exported (LHS)
■ UK reprocessing (LHS)
— Recycling rate (RHS)

Graph 6: Exports of recovered plastics



2007 data annualised from data to Aug 2007.

Source: HM Revenue and Customs.

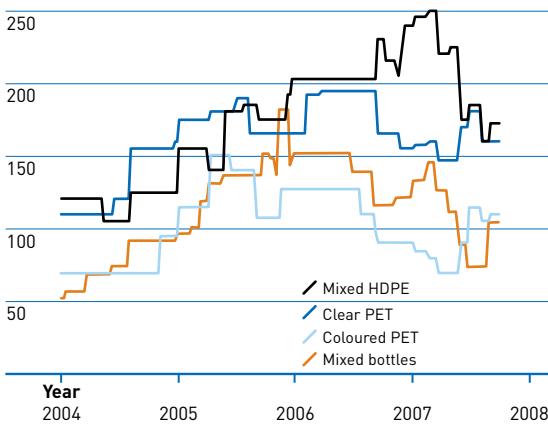
■ Destinations other than China/HK
■ China
■ Hong Kong (mostly on-shipped to China)

The average net CO₂ saving from recycling is estimated to be 1-1.5 tonnes CO₂ equivalent per tonne of plastics.



Graph 7: Recovered plastic bottle prices

£ per tonne
Data starts from April 2004



Source: Materials Pricing Report, midpoints of range.

The environmental benefits of plastics recycling

There are clear environmental benefits to producing plastic products from recovered polymers, compared with using virgin polymers and disposing of the product post-use via incineration or landfill.

The main environmental benefit lies in the energy saved by avoiding the processes of oil refining and polymerisation of monomers. These are estimated to account for over 95 per cent of the total energy consumed in plastics production.⁴

The average net CO₂ saving from recycling is estimated to be 1-1.5 tonnes CO₂ equivalent per tonne of plastics.⁵ The environmental gains from recycling plastic compared with landfill and incineration are, however, heavily dependent on the level of contamination of the recovered plastics. In particular, hot washing of plastics to remove contamination can be energy intensive, although some lifecycle assessment analyses suggest that net CO₂ benefits remain.

It is estimated that the 456,000 tonnes of plastics recovered in the UK in 2006 saved around 684,000 tonnes of CO₂ equivalent emissions, which equates to taking 216,000 cars off the road.

Prices

Prices for recovered plastics vary by polymer type, colour and quality, with natural HDPE and clear PET being more valuable than coloured or mixed polymers. Recovered plastics are significantly more valuable than some other dry recyclables, with a bale of clear PET or natural HDPE bottles being worth £150-£200 per tonne, compared with £60-£70 per tonne for paper and around £30 per tonne for glass.

Over the past three years, prices for recovered plastics have been much more volatile than those for other recovered materials (Graph 7). Prices rose sharply between 2004 and early 2006, reflecting both strong demand for recovered plastics and increases in virgin polymer prices. Prices for recovered PET and HDPE bottles – which had previously been closely correlated – diverged in late 2006, with HDPE reaching record levels while PET prices weakened. The divergence reflected a slump in Chinese demand for PET bottles, and was particularly pronounced in the coloured PET market. Mixed polymer prices were supported during this period by processors buying mixed polymers in order to extract the HDPE. Although prices for mixed HDPE fell in mid 2007, natural HDPE prices have remained strong. Prices appear, so far, to have been relatively unaffected by the recent increases in shipping rates, with overseas buyers reported to have absorbed most of the rise.

Prices for HDPE and LDPE films have fluctuated between £220 and £280 per tonne over the last few years, although prices fell from the top to the bottom of this range between April and September of this year.

Although PRN prices have increased during 2007 to date, to around £13 per tonne, they remain lower than their average over 2006 and substantially below their mid-2005 peak of around £75 per tonne. The low price reflects a perception that the 2008 packaging target will be relatively easily achieved.

WEEE plastics prices are reported to range from around £50 per tonne for mixed plastics to £120-£160 per tonne for plastics from refrigerators, TVs and monitors. Market contacts indicate that slightly higher prices are available in export markets than in domestic markets.

The challenges ahead

A key challenge facing the UK recovered plastics sector is how to maintain quality as a larger proportion of the material is recovered from post-consumer, rather than post-industrial, sources. UK material has a reputation for being of lower quality than recovered plastics from other countries. So there is a risk that if regulations on waste shipments are tightened and/or more adequately enforced, then demand for UK material might fall.

The continuing trend towards – and demand from households for – mixed plastics collections is a big challenge but also represents a major opportunity to increase UK plastics recycling rates. Particular challenges include the proliferation of polymer types (including bio-polymers), the high degree of contamination and the current lack of robust end markets for these materials.

Domestic plastics reprocessing seems to have declined in recent years, perhaps because of increasing global competition. Events in international markets in 2007 have underlined the potential risks in being dependent on one market for the UK's recovered material. Widening the markets for UK recovered plastics, for example through applications such as closed-loop bottle recycling, could help mitigate these risks.

The EC REACH⁶ regulation, which came into force in June 2007 to regulate the production and use of chemical substances, presents a further possible challenge to domestic reprocessing. Although the regulation doesn't apply to wastes themselves, the registration and information requirements relating to products made from recovered materials still need to be clarified.

Finally, the volatility in recovered – and virgin – plastic prices presents a challenge to market participants. One risk is that commercial collection and reprocessing operations that are profitable under current market conditions might become less viable if prices fall sharply. The special report section looks at the relationship between the virgin and recovered polymer market in more detail.

⁴ Source: US EPA.

⁵ WRAP (2006), 'Environmental benefits of recycling', http://www.wrap.org.uk_corporate/about_wrap/environmental.htm

⁶ EC Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemical Substances (REACH). See http://ec.europa.eu/enterprise/reach/index_en.htm for more information.



Special report:

The relationship between virgin and recovered plastics

Virgin polymer prices are one of the key determinants of recovered plastics prices. This article provides some background into the virgin polymer market and looks at how the prices for virgin and recovered polymers are related.

What are virgin polymers?

Virgin polymers are produced from by-products of the oil refining and gas processing industries, after the most commercially useful components such as transport fuel and natural gas have been extracted.

There are two main types of basic petrochemicals: *olefins* (straight chain hydrocarbons) such as ethylene, propylene and butadiene; and *aromatics* (ring chain hydrocarbons) including benzene, toluene and xylenes. These basic petrochemicals, plus the *chemical intermediates* produced from them, such as styrene, phenol and PTA, are processed and polymerised to produce virgin plastics such as polystyrene, HDPE, LDPE and PET.

Prices for virgin polymers

Markets for virgin polymers are centred on the three distinct regions with high end demand: Europe, Asia and North America. Prices can diverge between these regions, so this special report concentrates on recent developments in the European market.

As one might expect, virgin polymer prices are correlated with crude oil prices (Graph 8). Virgin HDPE prices have almost doubled in sterling terms over the past four years – broadly in line with the increase in crude oil prices. Virgin PET prices have also risen, albeit not to the same extent.

Historically, virgin PET has traded at a premium to HDPE, reflecting the perception that it is a higher quality product. But over the past two years, this differential has largely disappeared. Prices for both packaging grade PET and blow moulding HDPE have risen by around 10 per cent during 2007 to date, supported by rising feedstock costs and supply side concerns (for example, plans to close the Grangemouth HDPE plant).

The relationship with recovered polymer prices

Prices for processed recovered polymers are closely correlated with prices for virgin PET and HDPE. Indeed, market contacts suggest that recovered polymers are traded as a quoted discount to the virgin price.

It is notable that this correlation in prices is also apparent in the prices paid to collectors for their unprocessed recovered material. This means that while collectors benefit from any increase in polymer prices, they are also exposed to price volatility (Graph 9).

The link between demand and supply

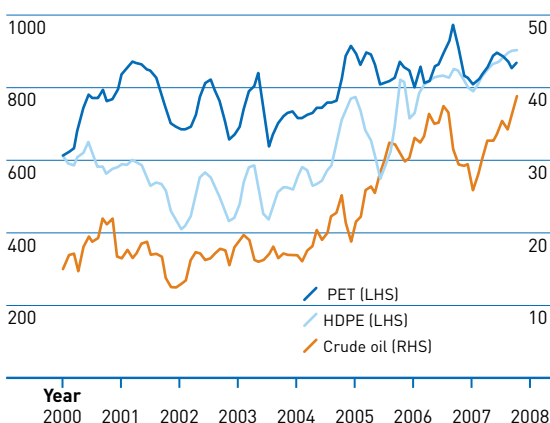
Where they can be freely substituted for one another, the demand for recovered plastics will be determined by the residual demand unsatisfied by virgin polymer supply. Recovered plastics are, in some cases, imperfect substitutes for virgin plastics owing to quality and technical limitations. However, this is changing as closed-loop recycling technology becomes established and as recycled content in plastic products becomes a marketable factor (for example because of corporate social responsibility agendas).

Because petrochemicals are by-products of the oil and gas industry, and due to the long lead times in investments to build capacity, the supply of virgin plastics does not tend to respond to short-term fluctuations in demand. If demand for a virgin polymer outstrips supply, prices will rise. Demand – and possibly also prices – for recovered plastics will increase in parallel. Conversely, when there is excess capacity in the petrochemical industry and hence an oversupply of virgin polymers, recycled plastics may be able to compete only if the material is of both lower cost and high quality. Lower quality recovered plastics may be squeezed out of the market.

The strength in virgin polymer prices over the past five years has helped underpin the development of the UK's plastics recovery infrastructure. The outlook for polymer prices remains strong, with polymer demand, particularly in emerging countries, expected to continue to grow. However, significant expansions in petrochemical capacity are expected in the Middle East in the next few years. Although some of this will replace retiring European capacity, a sharp increase in supply could temper virgin polymer prices, even if crude oil prices remain strong. If prices for recovered plastics were also to fall, this could reduce commercial incentives to further increase plastics recovery.

Graph 8: Crude oil and virgin polymer prices

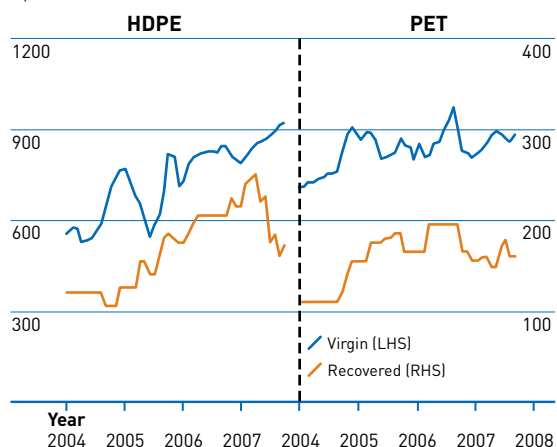
£ per tonne/barrel



Sources: www.pieweb.com, EIA and Bank of England.

Graph 9: Virgin and recovered polymer prices

£ per tonne



Sources: www.pieweb.com, MPR and Bank of England.

WRAP works in partnership to encourage and enable businesses and consumers to be more efficient in their use of materials and recycle more things more often. This helps to minimise landfill, reduce carbon emissions and improve our environment.

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

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