# Using recycled polymers in new products: a business opportunity

## Polymer use in the UK

In 2012 the global production of plastics was 288[1] million tonnes an increase of 2.8% on 2011. The European Union (EU 27+2) represents 20.4% of the global plastics production in 2012, with the UK producing 2.5 million tonnes.

The UK processes more than four million tonnes of plastics per annum. Approximately 40 per cent of plastics are used for single-use disposable applications, such as packaging, agricultural films and disposable consumer items, between 20 and 25% for long-term infrastructure such as pipes, cable coatings and structural materials such as windows and 6% for automotive use.

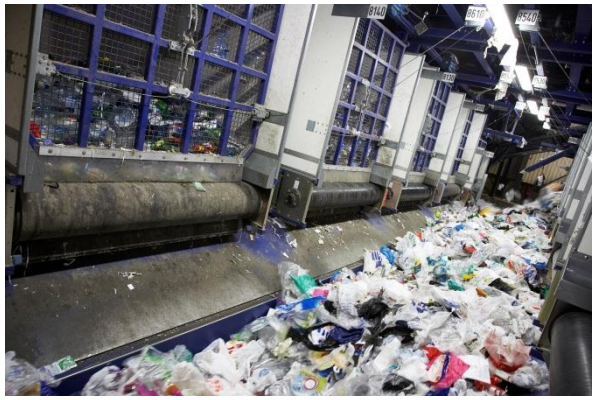

Figure 1: Plastic recycling plant

[1] BPF correspondence

In 2011, around 550,000 tonnes of plastic bottles, around 550,000 tonnes of non-bottle rigid plastic packaging (pots, tubs and trays) and around 550,000 tonnes of film entered the UK household waste and recycling system[2].

Whilst around 96% of Local Authorities provide a kerbside collection of bottles, almost half of bottles are still not recycled, costing local councils millions in disposal costs.


Figure 2: Bottles suitable for recycling.

## Recycled polymer availability

The UK generated over 500,000 tonnes of recycled polymers in UK which could be used in place of virgin materials with a potential reduction in cost and carbon footprint.

The majority of this material is polyethylene (PE), polypropylene (PP) and polyethylene terephthalate (PET) which can be fed straight back into packaging products and numerous other applications.

[2] *Plastic Composition 2011 Report- WRAP & Valpak 2013:* *http://www.wrap.org.uk/sites/files/wrap/Plastics%20Composition%202011%20Report.pdf*

WRAP has identified a number of business opportunities for increasing the use of recycled polymers in the UK. This document presents the business case for recycled plastics and is designed to highlight commercial opportunities in the UK.

## Target audience

This business case is aimed at senior managers at moulders, manufacturers brand owners and retailers who are looking to reduce the cost and carbon footprint of their products.

It may also be of interest to product and environmental managers of both domestic and commercial products and packaging.

## The benefits of recycled polymers

The cost of virgin polymers is dependent upon the cost of crude oil and can vary significantly across the year. Recycled polymer prices may not suffer from this fluctuation, as they are not directly connected to this price. This could lead to a significant saving per annum.

There is a significant reduction in carbon impact for products and packaging with recycled plastics: using a tonne of recycled plastic bottles (rPET or rHDPE ) in new bottles saves around a tonne of $CO_2$eq. (revised 2014)

There is also a growing demand for products with recycled content which creates a commercial advantage to products with a recycling story attached to it.

## Case studies

## High Density Polyethylene (HDPE) Milk bottles

HDPE is a type of resin commonly used in plastics bottles. It is widely used in the UK for fresh milk bottles, shampoo and detergent bottles.

Figure 3. HDPE milk bottles

Of the 316,000 tonnes of plastic bottles captured for recycling through local authority collections in 2012, HDPE bottles made up almost 50% of the stream. In the UK, in 2012, 77% of HDPE milk bottles were recycled[3].

A series of pioneering research and development projects led by WRAP, with industry partners developed the worlds' first process to recycle HDPE milk bottles back into food grade recycled HDPE (rHDPE) for use in new milk bottles[4].

[3] *UK Household Plastics Collection Survey 2013 – Recoup* http://www.recoup.org/

[4] http://www.wrap.org.uk/content/food-grade-hdpe-recycling-process-commercial-feasibility-study

Reprocessing facilities have been set up in the UK to produce food grade recycled HDPE and this has enabled the UK dairy industry to close the loop by manufacturing new milk bottles with recycled content - delivering environmental benefits through a reduction in landfill and carbon savings.

The Dairy Roadmap (formerly known as the Milk Roadmap) has set targets for the use of rHDPE in new milk bottles of 10% by 2010 (achieved), 30% by 2015 (on target) and 50% by 2020. Over 2 billion milk bottles sold per year on the UK market contain recycled HDPE.

Increasing the recycled content in plastic milk bottle packaging uses this resource more efficiently and realises environmental benefits by reducing the use of virgin plastic, saving energy and reducing greenhouse gas emissions.

## PP Paint tubs

A new plastic paint pail developed by RPC Containers Oakham for manufacturer Newlife Paints incorporates 25% recycled content.

The design was developed by RPC Oakham with UK suppliers of recycled plastics to ensure a high-grade polymer capable of withstanding the weight of paint. This new pot reinforces the environmental credentials of a new range of largely reclaimed paints being stocked by retail DIY chain B&Q.


Figure 4: Paint Pot Containing Recycled PP

RPC Oakham tests showed that the optimum proportion of recycled polymer for the 5-litre injection moulded PP pail was 25%, in order to maintain the highest standard of consumer functionality and convenience.

## PET bottles

Following trials in 2007 of recycled PET[5], a number of key brands and retailers are now using rPET across a number of product lines.

Marks & Spencer is using it across its 'Food to Go' range and other produce categories, while Boots has committed to the long-term use of rPET.

Figure 5: Variety of PET bottles

Over a six month period Coca Cola produced 75 million bottles made with 25% rPET with successful results. The trial also showed that using rPET reduces the amount of energy needed for bottle manufacture compared to virgin resin, offering a small saving in electricity costs. At the time the company was producing bottles in 17 markets around the world with up to 25%recycled PET content.

[5] http://www.wrap.org.uk/content/case-study-using-recycled-content-plastic-packaging-benefits

## Recycled HIPS and PCABS in electrical and electronic equipment

### Home Entertainment

WRAP conducted a number of studies to demonstrate that using recycled WEEE-derived plastics in high-performance electrical products could be a viable technical and economic option.

One project investigated premium audio equipment products for home entertainment. Bowers & Wilkins and Meridian[6], both global electronics companies, agreed to trial recycled plastics in some of their products, in place of the virgin plastics used at present for the components. Two products were chosen for the trial:

- 800 series hi-fi loudspeakers by Bowers & Wilkins (B&W); and
- F80 hi-fi by Meridian, co-branded with Ferrari.

The speaker grills are relatively large components (1080 x 220mm).

Figure 6. B&W speaker grills

[6] http://www.wrap.org.uk/sites/files/wrap/Demonstration%20of%20recycled%20content%20in%20electrical%20products%20summary%20report.pdf

While both of the products' parts are complex, the Meridian hi-fi components had more demanding physical moulding requirements.

Very few concessions were made in the moulding techniques for the trials. The recycled High Impact Polystyrene (HIPS) plastic was subjected to exactly the same moulding conditions as those for the virgin plastics. Some minor changes in moulding procedures were introduced for the PCABS plastic, due to slight differences in the material.

Overall, the study established that recycled plastics can perform to the standards required in premium audio products, and in some components better than virgin materials. Results included:

- A cost saving of 13% per tonne could be achieved using recycled HIPS in the Bowers & Wilkins loudspeaker grills;
- A saving of 72% $CO_2$eq per tonne could be achieved using recycled HIPS in place of virgin material;
- A saving of 50% $CO_2$eq could be achieved in producing the Bowers & Wilkins speaker grills with recycled HIPS; and
- A reduction in blowing agent was possible in the speaker mouldings using recycled HIPS.

### Washing Machines

A second project saw how Indesit Company worked with its subcontract plastic moulding company (RGE) to produce an access panel that will fit onto the back of a washing machine. The access panel is made by using recovered fridge waste, which is then shredded and made into a high grade polymer pellet. The access panel plate has been manufactured using 100 per cent recycled plastic with similar characteristics to the previous part that was made from virgin material.

The pilot project was considered such a success that the plate is now being integrated into the back of the premium Hotpoint Aquarius and Ultima Washing Machines.

Indesit Company has also adapted the production process to allow them to easily alternate between using virgin and recycled materials, providing extra flexibility.

Indesit Company expects that replacing virgin plastic with recycled plastic will result in significant $CO_2$ equivalent saving and at least a 5% saving in material costs for every tonne of recycled plastic used[7].

## Recycled plastics in sanitary ware

Through a project with WRAP, Ideal Standard has introduced recycled polymers into its range of valves for its toilet flushing mechanisms. This will result in over 750,000 items per annum being produced containing 95% recycled PP. This will result in an estimated carbon saving of 36.5t$CO_2$e as well as saving 46.5 tonnes of virgin polymer from being used and an annual saving in excess of £10,000 per annum.

Figure 7: Flush unit incorporating recycled content

[7] *http://*www.wrap.org.uk/content/weee-plastics-indesit-closed-loop-recycling-trial
[8] *http://*www.wrap.org.uk/22309

## Recycled household plastic film

A recent WRAP project identified alternative end markets that could introduce recycled plastic blags (PE) originated from kerbside co-mingled collections.

Different applications were tested including:

- film blowing (dispatch bags and silage sheeting);
- injection moulding using novel foaming technology;
- injection moulding (conventional) producing nestable storage and transport boxes;
- rotational moulded items, including animal feeder and automotive parts.

The results showed that high recycled content (up to 50%) could be achieved without compromising the quality of the end material, especially for the rotational and injection moulded parts.

Other applications, such as film blowing had some limitations on the amount of recycled content could be used before impacting on the printing quality[8].

Figure 8: Products produced using recycled film

## Commercial opportunities

These trials demonstrates that recycled PP, PE,PET, HIPS and PCABS could be used in new products with up to 30% and in some cases 100% recycled content while retaining the products performance.

There are other reasons for using recycled polymers:

**Show commitment:** demonstrate to customers you really are committed to corporate social responsibility and the environment.

Recent research from MIT Sloan Management Review and the Boston Consulting Group (BCG) in a report titled "Sustainability's Next Frontier: Walking the Talk on the Sustainability Issues that Matter Most" (December 2013)[9], highlighted a disconnect between belief and action. For example, two-thirds of executives rated environmental or social issues as significant or very significant, yet only 40% reported their companies were "largely" addressing them. Just 10% reported their companies were "fully" addressing these issues. Using recycled polymers will help companies towards addressing the environmental issues.

**Consumer preference:** research show that some consumers would favour an electronic item containing recycled content at the point of purchase – if two items had similar price, function and quality[10].

For rPET bottles consumer feedback has shown overwhelming support for the wider use of recycled materials in packaging and the potential to increase sales.[7]

Recycling plastic content can help to build brand loyalty and change perceptions[11].

**Maintain quality:** packaging products in recycled materials is possible without compromising performance, physical properties, storage stability or visual appeal. Other non-packaging products could also use recycled polymers at similar levels without compromising performance.

**Save money:** Some recycled polymers can be 10 to 20% cheaper than the virgin equivalent[12]. Bought in small quantities, rPET can be more expensive. However, once economies of scale kick in, the cost of rPET is comparable to virgin PET[13].

**Reduce the carbon footprint:** Recycled polymers could have a 60% lower carbon footprint than the virgin equivalent, dependent upon the recycling process that is used. Using a tonne of recycled plastic bottles (rPET or rHDPE) in new bottles saves around a tonne of CO2eq. (revised 2014)

**Saving energy, oil and volume to landfill:** Using recycled polymers will reduce the reliance on a finite resource (oil) for virgin plastic production and reduce the volume of plastic waste going into landfill.

## How plastics recycling works

Through the domestic and commercial and industrial waste streams the recovered polymers are segregated by type and colour, granulated, washed and extruded and chopped back into pellets ready for reuse. Some polymers also have additives added to enhance their properties. Food grade polymers are kept separate to ensure they can be reused in food packaging.

The recycled polymer can be blended with virgin polymers or used on its own. It is recommended that low levels of recycled plastics are trialled first and then increased in steps and re-tested to ensure that there is no negative impact on performance.

[12] http://www.wrap.org.uk/sites/files/wrap/Demonstration%20of%20recycled%20content%20in%20electrical%20products%20summary%20report.pdf
[13] http://www.wrapni.org.uk/sites/files/wrap/Using%20recycled%20content%20in%20plastic%20packaging%20the%20benefits.pdf

**Dispelling the myths**
There has been a long standing concern with the potential for problems with using recycled polymers, but the trials above have shown that with the right quality of recyclate these concerns are unfounded.

**"Will recycled polymers compromise the quality of my products"**

The case studies show that it is perfectly possible to package food, beverages and paintin containers containing a high percentage of recycled material without compromising performance, storage stability or visual appeal.

**"Is there enough recycled polymer for my company to use?"**

New plants in the UK in recent years have significantly increased the amount of HDPE, PP, PET as well as HIPS available in the UK. Now is the time to plan to use recycled polymers and benefit from the advantages they offer.

**" Will changing to recycled polymers jeopardise sales?"**

On the contrary, consumer feedback has shown overwhelming support for the wider use of recycled materials in packaging and the potential to increase sales.

**" Will I have to buy new production equipment?"**

This depends on your product and facilities. In some organisations, no new equipment will be required. In others, additional recycled material storage facilities and blenders will be needed.

**What are the challenges and how can they be overcome?**

The main challenge to overcome is the concerns of product managers with over specified material and cosmetic standards and to convince them that recycled polymers can and should be able to meet the basic requirements of their products. Trials with recycled plastics can provide the necessary evidence and confidence.

## Next Steps

This business case has shown the benefits of using recycled polymers for a wide range of products. Have you considered where you could use recycled plastics?

## Where can recycled plastics be sourced?

The BPF Recycling Group is the representative body for UK plastic recyclers. Members produce recycled materials to the highest possible standards giving confidence to the material. To find a recycler please see http://www.bpf.co.uk/Recycling/Find_a_Recycler/Default.aspx

For the BPFs Plastics Recyclers Buyers' Guide
http://www.bpf.co.uk/Document/Default.aspx?DocumentUid=7038D4AC-85FB-4A59-94FF-1DE12E74F555

## Is there any support to help introduce recycled plastics?

In addition to the support offered by WRAP, WRAP Cymru and Zero Waste Scotland, please see our list of potential funding support that you may be able to access http://www.wrap.org.uk/fundingsources

For more information about our work on recycled plastics and how it can benefit you, please visit

www.wrap.org.uk/plastics

June 2014



**Waste & Resources Action Programme**

The Old Academy
21 Horse Fair
Banbury, Oxon OX16 OAH

Tel: 01295 819 900
Fax: 01295 819 911
E-mail info@wrap.org.uk

**www.wrap.org.uk**