

Paper - the sustainable, renewable choice



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# THE UK PAPER INDUSTRY - INNOVATION AND THE BIOECONOMY

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## Executive Summary

### A NEW ECONOMIC MODEL - THE UK'S PAPER-BASED INDUSTRIES

The global economy is moving from linear to circular, prioritising renewability and recyclability over disposability and historic concepts of convenience. A step change improvement in resource productivity and the elimination of waste are key characteristics of this new economy. Critical to its development is the concept of using renewable biological resources to replace fossil resources in products, processes and services, something that has become known as the 'bioeconomy'.

The UK Industrial Strategy and the Clean Growth Plan both see a green economy as a huge opportunity. Indeed, the UK has published a policy document, Growing the Bioeconomy\*, setting out the challenge:

*'Building a world-class bioeconomy will transform our economy by removing our dependence on finite fossil resources. Bioscience and biotechnology has the potential to create new solutions that are economically and environmentally sustainable as well as resource efficient.'*

*'These solutions will help to tackle global challenges and create opportunities in agri-food, chemicals, materials, energy and fuel production, health and the environment.'*

The UK's Paper-based Industries support these ideas and are working alongside Government to turn these concepts into reality.

The following pages outline some great examples of innovation and new products being delivered by the paper sector in all parts of the UK, helping to realise both a circular and bio-based economy.

But the potential to go further is huge. Increasing recycling levels and providing recyclable and biodegradable alternatives to single-use plastics are two obvious examples.

For these opportunities to be realised in the UK, the Government needs to work with industry to address five key areas:

- **Energy** - competitively priced energy is a pre-requisite for energy intensive manufacturing industries.
- **Innovation** - R&D should be redirected to prioritise commercialisation in the UK.
- **Recycling** - collection systems should deliver higher quality recyclate ready for re-use.
- **Skills** - an ageing workforce needs suitably qualified staff to take advantage of new employment opportunities.
- **Investment** - the UK must be an attractive place for large-scale and long-term investment in capital assets designed for decades of operation.

Throughout this report we refer to the Paper Industry. This means a fully integrated value system based around paper and cardboard. Forestry and recycling providing raw materials for pulp; manufacturing sites making reeled paper and card; conversion operations making reels into paper-based products; and collection systems feeding clean used paper back for recycling.

\*[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/761856/181205\\_BEIS\\_Growing\\_the\\_Bioeconomy\\_Web\\_SP\\_.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/761856/181205_BEIS_Growing_the_Bioeconomy_Web_SP_.pdf)

## THE OPPORTUNITY

### The bioeconomy

The bioeconomy includes all economic activity based on bio-based products and processes and includes farming, fisheries, forestry, micro-organisms, and organic wastes. Research and innovation is delivering a range of new uses such as bio-based chemicals and new bio-based materials.

A move to a bio-based economy is part of the response to growing environmental challenges facing the global economy, with a particular focus on replacing single-use oil-based plastics that are hard to recycle and which accumulate in the oceans as litter or micro-plastics after they break-up into tiny particles.

Of course, papermaking is already firmly centered in the bioeconomy. Paper is made from renewable and recyclable fibres, with increasing amounts of energy being sourced from bio-based fuels.

The challenge for the Paper Industry is to continue to serve existing markets with traditional and incrementally improving products made in ever more sustainable ways. The opportunity is to take advantage of innovations and new ideas to use paper in different ways.

#### CASE STUDY

#### UPM - THE BIOFORE COMPANY

Leading a move towards a bio-based economy, UPM has refocused to use its global capabilities, innovativeness and strong position in the forest biomass sourcing chain to advance a circular economy as a core part of delivering long-term value creation.

As well as traditional products such as pulp, paper and timber, the company has diversified to add value through new products such as biochemicals, biocomposites, biofuels and energy.

UPM operates two integrated paper mills in the UK and produces labels in Scarborough. The two mills (Shotton in North Wales and Caledonian in south-west Scotland) both have modern bio-fired Combined Heat & Power (CHP) providing heat and power to supply the papermaking process. Additionally, Shotton also benefits from a large solar photovoltaic plant. In total the company employs around 1,000 staff in the UK.



James Cropper PLC recently made a bridge from paper to show the versatility of its product.

### Why Paper & Cardboard?

Paper is both renewable and recyclable, key advantages as society becomes increasingly concerned about environmental issues. Paper quite literally grows as trees, and recycling back into new products is the norm and has always been an integral part of the paper loop. Many people had their introduction to recycling by collecting newspapers!

These attributes place paper, and of course the myriad of different products based on the versatility of paper fibres highlighted in this report, at the centre of an increasingly important circular bio-based economy.

#### CASE STUDY

#### NEW USES FOR OLD FIBRES

Once the paper fibre reaches the end of its life as paper (each pass through the recycling process shortens and slightly damages the fibre so that after many cycles fibre becomes too short for re-use), damaged fibres, known as 'paper crumble', are generally used for soil improvement or energy production.

However, a number of alternative uses are feasible, thanks to the characteristics of the paper crumble. Large quantities are already used for animal bedding, taking advantage of the desiccant qualities of dried material. Some is used as an additive in building materials making lightweight blocks while the feasibility of using crumble as a feedstock for chemical production continues to be progressed.

Smithers Pira, Imperial College and 360 Eco have worked with several UK mills to develop a lightweight-filler ('Poraver substitute') from paper sludge ash and waste glass cullet. High temperature sintering of glass powder (80%) and PSA (20%) produces lightweight filler with potential applications in high value building applications where lightweighting is important.



## The UK Paper Industry

The history of paper goes back thousands of years to ancient Egypt and China, when long vegetable fibres from papyrus were formed into paper using a mesh to strain fibres from a thin soup to make sheets of paper. Modern paper mills use essentially the same process to produce highly engineered product from cellulose fibres.

Each machine is specialised to produce a particular class of product. These naturally split into four main groups - graphics, packaging, tissue, and a wealth of speciality products.

While a paper machine making cardboard packaging grades from recycled boxes makes several hundred thousands of tonnes of product each year, a small speciality mill may only make a few hundred tonnes over the same period.

### CASE STUDY

#### PALM NEWSPRINT IN KINGS LYNN

In 2009, Palm Paper opened a new-build mill in Kings Lynn, recently adding its own CHP plant to produce both electricity and heat used in the production process and supporting the national grid. The total investment into the new site is now in excess of £500m

supporting hundreds of jobs and recycling huge amounts of UK sourced paper.

The paper machine ('PM7') runs at almost 2,000m per minute and the site produces around 400,000 tonnes of 100% recycled newsprint each year, much to an improved quality allowing use in products where traditionally virgin fibre would have been specified. After use, the paper can be recycled again back into new paper either in Kings Lynn or at another recycling mill.



#### WEIDMANN WHITELEY IN POOL-IN-WHARFEDALE

By contrast, Weidmann Whiteley is focused on manufacturing low-volume engineered paper products used in industry, notably in the power sector. Part of the operation of its mill in Yorkshire specialises in the manufacture of cellulose based engineered paper. This paper (Electrical Insulation Press Paper) is used in the manufacture of power and distribution transformers, while precompressed board is made into insulation components essential for the operation of power generation equipment including renewable technologies such as wind turbines.

The company offers a full range of solid insulation components for power and distribution transformers, both standard and a range of tailor-made solutions. Components are manufactured in a variety of processes from dry to wet sheet material, with various sub-assemblies made on site and exported all over the world.



**WEIDMANN**

As part of the 'Beyond the Box' campaign, a sculpture of the Greek god Atlas, carrying the weight of the world on his shoulders, was created entirely from cardboard.



Photo: John Nguyen/PA Wire

## Forestry - more trees!

A move from non-renewable resources to bio-based ones only works if it delivers environmental benefits.

Forests have a central role to play in protecting the environment by absorbing and storing carbon, regulating water flows, hosting wildlife, and providing recreational opportunities. Well-managed forests also have a role as a source of sustainable raw materials with opportunities for use by both local communities and industry.

Indeed, sustainable harvesting can be fundamental to avoiding the permanent conversion of forest land to other uses. Income from the sale of forest products acts as a powerful incentive for landowners to keep existing forests and add new ones.

Proper forest management can reconcile these varied roles, helping avoid conflicts that result in unsustainable actions that damage forests. This issue is increasingly important as new parts of industry look to forests to provide raw materials to drive an expanding bio-based economy.

Of course, a bio-based economy needs sustainable bio-raw materials in increasing quantities that should be delivered by a huge tree planting programme. In the UK, the post-Brexit agricultural policy is a major opportunity to increase UK tree cover.

### CASE STUDY

#### SUSTAINABLE FORESTRY

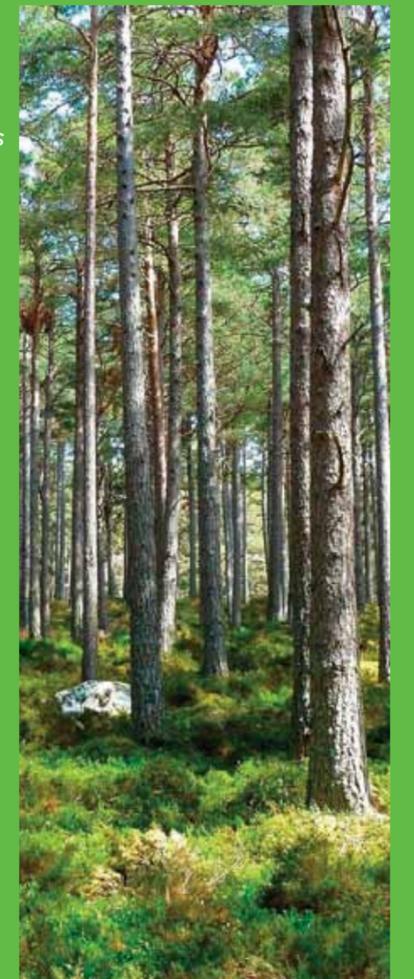
A key advantage of paper over other materials is the renewable nature of wood and the recyclability of paper fibres. Growing trees in well-managed woodlands reabsorbs carbon dioxide delivering a 'shallow carbon cycle', unlike carbon dioxide released from non-renewable resources (such as fossil fuels) where 'deep carbon cycles' are measured in millions of years rather than decades. This is an advantage of bio-paper over fossil-plastic.

The sale of timber and timber products from forests provides income for forest owners and a huge incentive to ensure that land remains used for forestry and not converted for other uses. Indeed, properly managed forests don't just provide timber products, they also have key roles in conservation, recreation and in storing and cycling carbon.

Added to these existing benefits is a quickly growing interest in the potential to grow a bio-based economy, with non-sustainable products increasingly being swapped for sustainable ones.

Kielder Forest, the new National Forest and development of new Community Forests all show what can be achieved with focused support to get more trees planted and new areas of woodland established.

Indeed paper companies can go further, with active support for planting programmes linked to long-term supply contracts. The Iggesund 'Grow Your Income' programme in northern England has resulted in new energy crop planting on marginal land, adding to biodiversity and helping farm diversification.



Smurfit Kappa provided a seat made from cardboard for the Pope to use during his visit to Ireland.



## Raw materials

Pulps have different characteristics depending on the type of raw material used in their production, the processing system they pass through, and their intended use.

Recycling essentially makes use of water, a little heat, and mechanical mixing to split the paper back into fibres, with water cleaned and returned to the environment after use. Virgin wood pulp is made by mechanical grinding or chemical treatment (or a combination of the two). Mechanical pulping is higher yield, but the high lignin content makes the pulp best suited to shorter-life products (all virgin pulp made in the UK is thermo-mechanical). Chemical (or kraft) pulping is lower yield, with the low lignin content making pulp best suited to longer-life products such as books and office papers. The tree species used also has a huge impact on the fibre characteristics, with a big difference between hardwood and softwood fibres.

These different types of fibres provide a palate of characteristics to choose between when making new products and are reflected in the wide variety of different grades of paper that are sold.

### CASE STUDY

#### TISSUE IS MADE FROM A BLEND OF FIBRES

Hardwood fibres (often from quick-growing eucalyptus) are short but soft, while softwood fibres (from conifers) are longer but coarser. To make best use of these characteristics, and use materials efficiently, tissue machines process the different types of fibre into layers to give the inside of each sheet strength and the outside softness. Depending on the product specification, recycled material can be included in the blend and the overall thickness and number of layers varied.



## Papermaking co-exists with other wood-based industries

Around 330m tonnes of wood is used as feedstock by the global paper industry each year. This yields around 170m tonnes of pulp, with around 160m tonnes of wood-based material (mostly lignin, hemicellulose and other extractives) available for other uses.

Many of these pulp making by-products (together with process waste from recycling operations) are currently used for energy generation, as are increasing amounts of woodchips. But these materials could be used as a feedstock to an enhanced and high value bio-based economy. Energy generation would still be an important end-use, but re-focused onto waste materials and only after higher value uses have taken precedence, in-line with the principles of cascading use.

Chemical pulp production is a long-established process using chemical catalysts at large scale and high temperatures. Production plant is capital intensive and large-scale. Research is ongoing to identify natural solvents that work at lower temperature. If this new technology can be commercialised it delivers the possibility of smaller low-cost production units working from a wider range of feedstocks.

The UK is strong in this research area with, for example, the University of York having a specialist Green Chemistry Department researching the extraction of high value chemicals from paper processing wastes.

The UK also has a network of biorefinery research centres. The world produces 175 million tonnes of chemicals per year, much of which could be replaced by wood-based chemicals. Lignocellulose can be turned into carbon fibre which, in turn, is the base for new materials that can compete in strength with steel or replace oil-based materials.

Indeed, dissolving pulp is already widely used in applications previously supplied by oil-based products. The very pure and high cellulose content of chemical pulp is dissolved in solvents allowing it to be spun into textile fibres and other useful materials.



Hollingsworth & Vose make glass fibre-based papers used as separators in electrical equipment. These materials are central to the operation of batteries used in electric powered cars.

## Alternative fibres

While most paper is made from wood pulp, other types of fibres make other types of products. Toilet tissue is very different from a cardboard box, and a bank note very different from a tea bag.

Before modern machinery allowed cost-effective processing of wood, fibres were made from materials close to hand. Paper-like materials have been in existence for thousands of years since the times of the Ancient Egyptians and the Chinese dynasties. In the Middle Ages in Britain, paper was made by beating old rags to release cellulose fibres which could then be formed into a paper sheet. Some of these traditional materials continue to be used in the modern industry, for example, cotton for long-lasting security papers, and abaca for filter papers.

In the UK, with limited forest resources, around three-quarters of the raw material used for papermaking is recycled paper and cardboard. These raw materials are often blended to provide the right mix for the product being made.

Several UK companies are actively looking to develop papermaking pulps from agricultural residues such as straw. These ideas aren't new, but the high silica content of some of these materials presents a challenge to the operation of plant as abrasive silica can substantially reduce the operational life of machinery.

### CASE STUDY

#### NEW BIO-BASED MATERIALS

A huge amount of research is being carried out to develop new products based on bio-materials, often targeted to replace those made from non-renewable resources. The UK already has expertise in this area with a network of bio-based R&D centres.

We're already seeing innovative building products, new wearable materials, and a range of chemicals extracted from wood.

One of the strengths of UK plc is its University led R&D base. Traditionally these facilities are considered strong in basic research, but weaker in translating break-through ideas into UK manufacturing. Government support is being better targeted to support this aspiration with a range of collaborative networks now established.

The BEACON Biorefining Centre of Excellence is a partnership between Aberystwyth, Bangor and Swansea Universities, working in the field of conversion of biomass and biowastes into bio-based products with commercial applications.

BEACON primarily helps businesses explore bio-based opportunities for growth by providing access to wide-ranging specialist equipment and scientific expertise of the three partner institutions, including the Bio-composites centre at Bangor.



### CASE STUDY

#### HUHTAMAKI'S MOULDED FIBRE BUSINESS HAS INTRODUCED EGG PACKAGING MADE WITH GRASS FIBRES

Building on research undertaken at Bangor, Huhtamaki has developed the world's first packaging consisting of 50% grass fibres as a step towards more sustainable production and raw material use; both concepts being at the core of Huhtamaki's approach to environmental responsibility.

Huhtamaki's standard moulded fibre products are already environmentally friendly since they are produced of recycled paper. GreeNest, however, goes a step further in resource-efficiency. Using a mixture of grass fibres and recycled paper helps to reduce the use of water in production and lowers the emissions of greenhouse gases by around 10%. In addition, less paper is needed for the production as grass fibre is included in the mix.

Huhtamaki operates a moulded pulp production site in Northern Ireland employing over 200 staff.



### CASE STUDY

For the last three centuries, PORTALS has been making security paper for use in banknotes and security documents such as passports, vehicle registration documents, and birth and marriage certificates. Throughout this time they have established themselves as a pioneer in innovation within the security paper industry, including being the inventor of the windowed security thread seen on many banknotes and passports today.

Today, its two UK sites produce high security paper for more than 12 billion banknotes, 200 million brand labels, 70 million passports and 60 million certificates each year, for use in more than 100 countries around the world.

Every product is bespoke with a unique combination of cylinder mould watermark and additional security features (including security threads, holograms and additional additives such as tamper resistant chemical sensitive dyes) meaning each customer has the flexibility to choose a paper solution that complements their security strategy and design requirements.



### CASE STUDY

VERNACARE use pulp made from recycled newsprint to make disposable moulded pulp products used for sanitary purposes in the hospital and care sectors. After use, the product (and its contents!) is simply macerated and disposed to the public sewer. Vernacare is experimenting with different types of fibre to improve production and performance.



## Replacing plastics

The BBC 'Blue Planet' documentary highlighted the growing environmental impact of plastics especially when they escape into the wider environment. While plastic is an incredibly useful material, there's a strong case that more sustainable alternatives need to be used for some applications, and indeed regulations are on the way to ban plastics from certain uses.

### Step forward paper!

Traditional cardboard boxes and paper bags continue to be the key to transporting and protecting goods in transit. In recent years, over a billion pounds (and counting) has been invested in new UK production facilities to manufacture recycled cardboard ready to make into new packaging.

These new and rebuilt paper mills use world class technology to make performance-based packaging designed for specific uses. Large central mills make easy to transport base-papers, with conversion into ready to use packaging carried out close to (or even at) the final customer.

### CASE STUDY

Between the three biggest packaging companies, in excess of a billion pounds has been invested in new or rebuilt paper mills over the last few years. DS Smith and Smurfit Kappa have rebuilt and invested in existing sites in Kent and Birmingham, while Saica has built a completely new mill on brownfield land near Manchester. Between these four sites, around two million tonnes of overwhelmingly UK sourced paper and card is recycled each year.

### MADE2FIT

All the companies are seeking to better match packaging to its intended use. DS Smith has developed a new box making machine to specifically tackle the e-commerce challenge of over-large boxes that waste both material and add to transport costs. Creating the right-sized pack lowers costs for e-tailers by reducing both operational and shipping costs: saving storage space, cutting labour costs and order administration, and greatly cutting assembly and packing times. It also significantly reduces product movement within the box, helping to reduce damage.

The new machine is placed at the customers site; the manual version designed for lower volume orders, creating 39 possible box size combinations from just three blank sizes of cardboard; while the larger version has the capability to manufacture more than 10 million box size combinations.



### CASE STUDY

### HOT FOOD TAKEAWAYS

Traditionally, recycled newspapers served as wrappers now replaced by newly made (but unprinted) newsprint paper which, if made in the UK, is 100% recycled. Many takeaway shops are switching from plastic to cardboard containers on environmental grounds. Cardboard boxes are now used by around a quarter of chippies, up from none 10 years ago.

The boxes are a great example of clever design. Micro-fluting gives strength but thinness, with the inner liner being made from food-grade virgin paper to aid absorption and keep product in peak condition during the trip home.

Single sheet cardboard boxes are also being used - with new and improved liners delivering the required product performance. The clean and crisp structure of the boxes giving the right image for the modern takeaway business.



**Nintendo Labo** is a gaming and construction platform used as an extension for the Nintendo Switch game console. The platform uses kits that include cardboard cut-outs and other materials to be assembled in combination with the Switch console to create "Toy-Con" that can interact with game software and vice versa. Nintendo designed Labo as a way to teach principles of engineering, physics, and basic programming.

While building and operating paper mills is capital intensive, flexible and modern plants that convert paper into finished materials are operated by a large number of firms. This diversity, and the improved quality of recycled product, allows innovation and the pages that follow contain some examples of new types of packaging that are replacing plastics. Critically they are easy to recycle, but if they do end up as litter they biodegrade quickly and don't cause long-term problems.

Retailers are increasingly turning from plastics to paper-based packaging. Iceland Food Stores has announced a switch from plastic packaging and most other major retailers have similar initiatives.

# PACKAGING INNOVATION

## Food Contact

Paper made from virgin fibre is widely used in applications where materials need to be protected from contamination. Often products made solely from virgin fibres are suitable, but alternatively, manufacturing techniques can layer different materials into the product. The food contact surface can be a layer of virgin fibre, with different layers throughout the product. If required, this can include barrier materials such as ultra-thin aluminium providing a complete block to vapours or contaminants.

### CASE STUDY

#### NEW USES FOR TRADITIONAL PRODUCTS

As well as these layered and composite materials, traditional paper products are being tweaked for new uses. AW Translucent Papers at Chartham in Kent make papers traditionally used for technical drawings. While this established use has declined over time, these papers are finding alternative use as food contact packaging often replacing paper mimicking plastics with real paper!

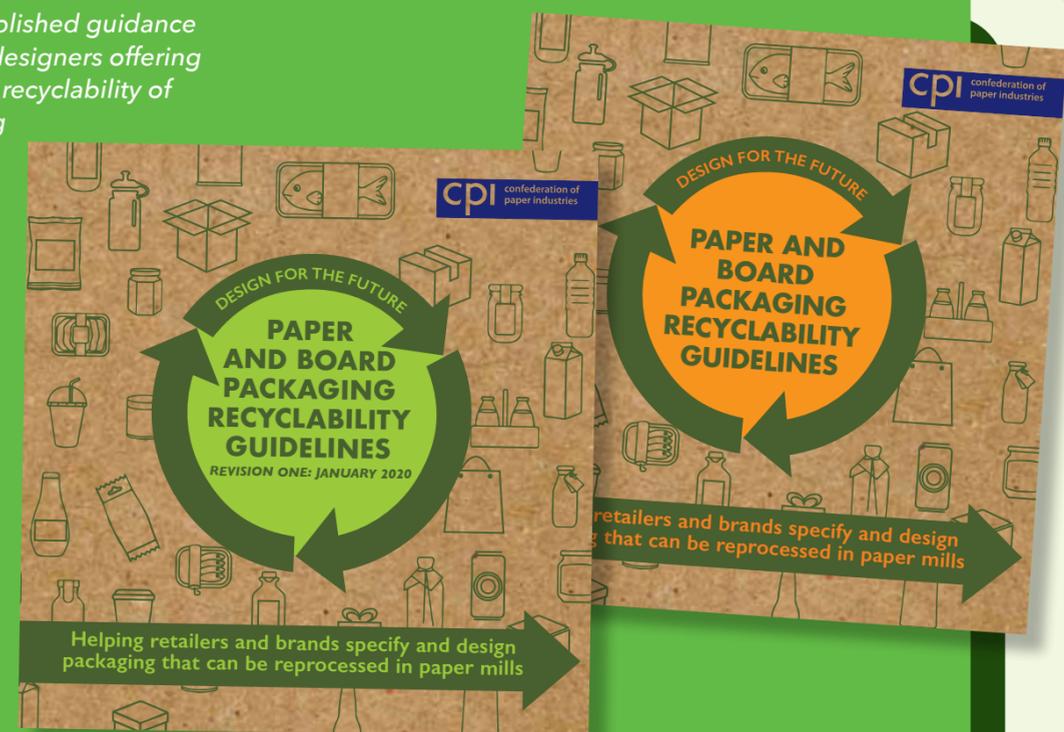
ClearPack is an uncoated paper that acts as a functional barrier against oxygen, odours and mineral oils while protecting the aroma and freshness of the packaged product. It can be printed, coated, laminated to other materials and highly tailored to provide bespoke paper-based alternatives to plastics.



### CASE STUDY

#### IMPROVING THE QUALITY OF RECYCLATE

CPI has published guidance to product designers offering advice on the recyclability of various packaging materials after their use. The intention is to help ensure that products put onto the market can be properly recycled.



## Supporting Recycling and the Circular Economy

For the UK, a key challenge is growing the availability of all types of domestically produced biomass. One particular opportunity is obvious - making better use of recovered paper.

As recycling levels have increased across the country, domestic reprocessing capacity has not grown to keep up with the amount of material being collected. The growth of commingled recycling collections (that can result in contaminated feedstocks which are difficult to recycle), is a huge problem and exports of collected paper have quickly grown to provide outlets for lower grade materials. More than half of the paper collected in the UK for recycling is now exported un-reprocessed - a massive missed opportunity and abdicating the proximity principle for the treatment of waste.

This feedstock, together with other organic wastes, presents a great opportunity to add value in the UK.

**Tork EasyCube - data driven cleaning.** Essity has developed a new software tool to support washroom cleaning. Cleaning teams get real-time data about cleaning needs, making it possible to stay ahead of the game and do exactly what's needed when and where. New tissue dispensers are designed to stay full longer, with automatic calls for refill. The days of empty rolls and despairing searches are gone!

With increasing amounts of materials being collected for recycling, actual facilities to recycle collected materials are needed. Once again step forward paper! Recycling has always been an integral part of the paper cycle and indeed the predominant raw material used by the UK industry is recycled fibre.

Even though there's been a huge effort to increase recycling there's not been a similar effort to increase UK reprocessing facilities meaning that, for most materials, increasing amounts of UK collected materials have been exported for reprocessing, sometimes to developing nations with less stringent environmental regulations.

## CASE STUDY

### PROCESSING PAPER BACK INTO PULP

*Traditionally, the physical recycling of paper back into pulp has taken place at papermaking mills. However, several projects are currently exploring the opportunity to integrate pulp making into recycling parks where the pulp making uses heat from on-site energy from waste plants.*

*Rather than selling paper and card ready for recycling, these new sites are seeking to sell ready-made pulp.*



### On shelf-performance and beating customer expectations.

*Increasingly sophisticated production allows product designers to add innovation to product. A specially designed and waterproof inner lining has been used in making a corrugated beer box designed to split open, that with the addition of ice, turns into an instant party dispenser for cooled canned drinks.*

To some extent increasing exports has hidden a growing problem with contamination caused by commingled collections in recycling systems, with such lower grade materials being exported. However, this is quickly changing, with China imposing strict quality standards and other export destinations following suit. This presents a major challenge for the UK, and a great opportunity to increase domestic recycling.

Of course, the UK industry is rising to this challenge. Recycling plants are being reconfigured in varied ways to make best use of recycling streams, and a number of companies have invested in their own collection schemes and pre-sorting facilities to upgrade quality.

## CASE STUDY

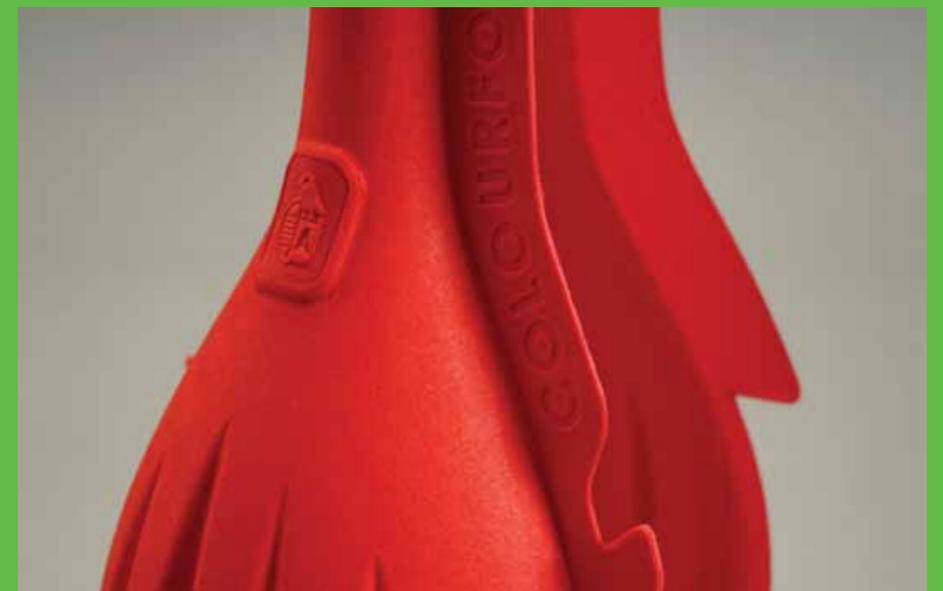
### HARD TO RECYCLE MATERIALS

*Multi-layer materials, such as single-use coffee cups and juice cartons, tend to be hard to recycle as the different layers are strongly bonded to each other. Indeed, 'conventional' recycling plant can struggle to recycle these materials.*

*Two UK mills (James Cropper PLC and Sonoco) have gone further and invested in specialist plant to specifically process these materials and recover the different layers, though of course it's the recovered paper fibres they directly use for their own production.*

*Sonoco integrates its recovered fibres into its normal products (mostly cardboard cores used in industry), while James Cropper uses the fibre recovered from coffee cups to create colourful papers and also its latest development in moulded fibre packaging - COLOURFORM.*

*A good example of how this material can be used is a partnership between James Cropper and LUSH to create a standalone COLOURFORM box that holds a selection of solid bath oil balls. Customers choose their own selection of bath oils, carry them home and then re-use their box on their next visit to the LUSH store. The box uses natural hinges and clasp closure with precision embossing to celebrate the LUSH brand. After its final use recycling is recommended, and the box is 100% recyclable through normal recycling collections.*



## CASE STUDY

## IGGESUND PAPERBOARD BIOMASS CHP

The mill makes Incada brand paperboard, formed of a central layer of mechanical pulp (produced on site from UK wood), which gives a low weight combined with high stiffness. The outer layers are made of chemical pulp to create high whiteness and good printability. Incada is currently used for packaging, book and brochure covers and other graphical applications.

Papermaking is a good match for high efficiency CHP (producing electricity to drive machinery and heat to dry the paper) and in common with most large paper mills the site has invested in CHP. Older gas-fired plant has been replaced with new biomass-fired equipment, using wastes from the pulp making operation as well as low grade forest residues and contract grown short rotation biomass provided by local farmers. Index-linked and long-term contracts, together with technical and harvesting support from Iggesund, have delivered a new and stable income source for local farmers, with the project delivering around 25,000 tonnes of short rotation coppice fuel to the mill last year.

The investment in the CHP (in excess of £100m) has made the mill self-sufficient in electricity and heat, while also exporting green electricity to the grid.

For the mill, the emissions of fossil carbon dioxide from the production process have now fallen to almost zero, an increasingly important issue for its customers concerned about the environmental credentials of its product. Switching to paper-based materials enhances the sustainability image of the brand owner.



## CASE STUDY

## PAPER AND TECHNOLOGY WORKING TOGETHER

PowerCoat is a microscopically smooth 100% paper substrate with a specially adapted coating that creates the ideal surface for printing electronic circuits directly onto the paper, eliminating the need for plastics and additional processes. It is recyclable, biodegradable and FSC certified, and thanks to its inherent paper qualities, it is lightweight and flexible, so circuits can be folded, cut, torn or even burned to produce any desired function.

The opportunities from this new product are starting to be realised. PowerCoat Alive comes with embedded Near-Field Communication (NFC) technology, that allows data transfer to smartphones and tablets. Simply tapping a phone onto the paper can transfer data or take the device straight to a specified website or video.

The first uses have been in business cards transferring details straight to phones, but exciting uses in high class and security packaging are expected....

PowerCoat is made by AW Creative Papers at its Stoneywood Mill in Aberdeen.

## Paper in buildings.

Paper-faced plasterboard is a feature of almost all new buildings, and the temporary cathedral in Christchurch, New Zealand (the first new building after the devastating earthquake) even used reinforced cardboard tube as roofing trusses. The designer (Japanese architect Shigeru Ban) has a long record of using quick to assemble and cheap cardboard in disaster relief operations.

## Making More with Less - Energy Efficiency

Much innovation in the industry is behind the scenes, making product more efficiently. This runs right the way through the supply chain, from the way the pulp is produced (where new enzymes are being designed to work at lower temperatures); the way the pulp is transported (specially designed ships and trucks to maximise supply chain efficiency); the way the product is made (huge improvements in energy efficiency), and the way the product is recycled (changing collection systems to deliver high quality material ready to be recycled).

**Energy Efficiency.** Papermaking requires electricity to drive machines and heat to dry the product. Water content is reduced from over 99% in the pulp mix entering the papermaking process to around 7% in finished paper in seconds by a combination of physical drainage, pressings and heat. Huge amounts of R&D have been deployed to better understand the dynamics of the process at a molecular level and find more energy efficient ways to remove the water. Much of this work is incremental and indeed major energy savings have been delivered by cumulative changes to machines.

Combining the generation of electricity and heat into one operation within a Combined Heat & Power Plant (CHP) is intrinsically more efficient than generating electricity and heat separately. Paper mills are huge investors in CHP and more than three quarters of the paper made in the UK is produced at sites with their own high-efficiency gas or biomass powered CHP.

## CASE STUDY

## CFQ STANDARDS

Supporting supply chain efficiency is a key advantage for paper-based packaging. Products can be made specifically to the optimum size, with industry standard manufacturing allowing IT systems to optimise supply logistics. A new system (CFQ -

Common Footprint with Quality) is focused on fruit and veg trays and guarantees that different sized trays will fit together and maximise the use of each pallet. After use, close to 100% recycling rates from the back of stores are achieved, taking the used packaging straight back to mills for recycling into new product.

