

Resource Efficiency

Resource Efficiency is one of those common-sense ideas that's drawing increasing attention as a route to minimising environmental impacts. Improving Resource Efficiency promises reduced demand for raw materials, less energy consumed in manufacturing, increased recycling and less waste – all contributing to delivering environmental and climate ambitions.

The paper-based industry is already built on resource efficiency, with renewable and recyclable bio-based fibres being widely recycled, and productive use made of production by-products.

Recycling always has been a fundamental part of the paper cycle - raw material use is minimised, energy used efficiently, and the maximum benefit drawn from fibres. Indeed, any company that wants to stay in the sector already needs to be resource efficient. The principles can be seen threaded through our paper-based industries. It's good to see these themes being more widely promoted and spread across the economy.

The Government defines resource efficiency "as the optimisation of resource use so that a given level of final consumption can be met with fewer resources" and has recently published [research into resource efficiency](#) across a number of industrial sectors. As with most simple concepts, in reality it gets more complicated as the details are unpicked – nonetheless the idea is sound and in practice the principles already underpin the Paper Industry for both environmental and economic reasons.

This document splits resource efficiency into two key areas and expands on the research published by Government. The paper explores the existing position for each resource efficiency measure and (where appropriate) indicates where government policy intervention is required.

A circular bio-based economy – extracting maximum value from inputs:

Increasing the use of recycled fibre
UK recycling systems
Design for recycling
Using process wastes
Product substitution

A resource efficient industry - minimising the use of resources:

Energy efficiency
Water efficiency
Process efficiency
Alternative fibres
Lightweighting

Resource Efficiency

Strategically, the UK needs:

- **A Green Industrial Growth Strategy with long term policy stability**
- **A revised strategy to support the high quality recycling of paper**
- **A more competitive business environment to attract new investment**

All of these ideas are explored in various position papers that can be found on the CPI website at: www.paper.org.uk.

- **Increasing the use of recycled fibre**

Recycling has always been part of the paper cycle. However a proportion of fibres are inevitably lost to the system and each cycle of recycling slightly damages the fibres, meaning some virgin fibre products will always be needed to ensure a suitable pool of material is available for recycling. Around three-quarters of fibres used by the UK papermaking industry are already drawn from paper for recycling.

However, the UK already collects more paper and card for recycling than can be domestically recycled – accordingly we have a significant surplus of collected paper potentially ready for domestic recycling. But the quality of this material has fallen due to a combination of factors, including the rising adoption of commingled collections and an inadequate focus on quality sorting at Material Recycling Facilities. The result is a decline in the quality of post-consumer Paper for Recycling delivered to UK paper mills and a greater difficulty in exporting some grades.

Addressing these quality issues is critical to making an increase in the use of recycled fibres possible. The delivery of Extended Producer Responsibility (EPR) and Simpler Recycling must be accompanied by investment in infrastructure for the collection, sorting, and processing of recyclable materials, to enhance efficiency, reduce costs, and make recycled fibre more economically viable.

- **UK recycling systems**

Collection methods play a pivotal role in achieving high-quality recycling. Separate collections are crucial in this effort, as they help prevent cross-contamination. To increase

recycling rates, a robust regulatory regime is essential, with separate collections to enhance the quality of recycled fibre.

CPI welcomed the Separation of Waste (England) Regulations 2024 which require the separate collection of paper and card. These regulations have the potential to drive high-quality raw material to reprocessors. However, the delivery of these regulations must be consistent across local authorities, otherwise exemptions risk undermining progress. Secure markets for recycled materials are essential. Without effective and consistent implementation of Simpler Recycling—focused on improving the quality of Paper for Recycling—the UK risks significant impacts on its paper production and recycling infrastructure, alongside challenges in maintaining export outlets.

It's essential to actively attract and retain investment in domestic paper reprocessing and provide support, incentives, and investment in technologies for the reprocessing of harder-to-recycle fibre-based materials. This can be achieved by providing funding streams to broaden the range of fibre-based packaging items that UK paper mills can effectively reprocess.

Shaping recycling systems through policy and regulation is of the essence, and implementing the EPR recyclability assessment methodologies linked to a robust labelling scheme can help streamline the recycling process and improve efficiency. As a result, public participation in recycling systems will increase, reducing contamination and optimising resource recovery efforts.

- **Design for recycling**

Designing for recycling is crucial for creating products that can be efficiently recycled at the end of their life. CPI has worked extensively within the Paper Industry and supply chain to help designers and specifiers develop products that are easily recyclable. The 5th edition of the [CPI Design for Recyclability Guidelines](#) is being drafted, with the document helping packaging developers determine the recyclability of their products.

Extended Producer Responsibility (EPR) is an opportunity to further develop these principles, with the promise of lower compliance costs for easy to recycle materials. That said, the current fee structures may adversely lead to inflationary pressures and reduced incentives for sustainable materials. A more balanced approach would recognise the renewability of fibre-based packaging and encourage innovation in sustainable design. Educational initiatives to raise awareness about the importance of recycling and the benefits of using products made from recycled fibre can encourage consumers to choose such products.

- **Reducing and using process wastes**

These wastes largely arise from the physical processing of paper for recycling, with two main types of waste – unwanted materials mixed with collected paper and card (contras - largely removed by pre-screening in and around pulpers) and short fibres and mineral fillers (largely arising from the actual reprocessing process itself). These two sets of materials are already managed to maximise recycling levels.

All sites have goals to reduce waste to landfill and a number have ambitious zero waste to landfill goals. Sites are also subject to waste minimisation audits under ISO 14001 and conditions included within their Environmental Permits.

The contra waste stream is rich in plastic and metal packaging waste which comes in mixed with the fibre stream and is the most difficult process waste stream to manage. However this material is high in calorific value and increasingly recovered through energy recovery, with associated recovery of metals.

It's clearly to the advantage of the mill to maximise the volume of fibres recovered from the process waste, meaning that what's left is predominantly sludges (formed of short fibres and mineral fillers) which are mostly sent for landspreading (taking advantage of the organic fraction and liming value of the fillers for agriculture), composting or processing into animal bedding.

The industry already works closely with the environmental regulators to minimise the volume of these wastes and maximise recycling and recovery. A stream of innovation is increasingly seeing these waste streams as a secondary raw material with a number of ideas being progressed to further increase the already high rates of recycling and recovery.

- **Product Substitution**

Paper fibre-based products are made from Paper fibre-based products are made from renewable and sustainable materials that are part of the solution to resource use. Unlike materials based on finite materials (such as metal or petrochemicals) the raw material base can be increased in a sustainable way by more tree planting, better recycling and widening the type of organic fibres used. These changes can already be seen in the marketplace as paper-based products replace plastic in packaging applications.

Simple policy interventions in this area are difficult as they need to address complex life cycle calculations and balance different factors against each other. One set of ideas that have been

proposed are based around mandatory product standards that (for example) could mandate minimum levels of recycled material being contained in new materials. However even this seeming sensible approach needs to be carefully framed to avoid distorting the market, as virgin fibre products tend to be made at mills using zero-carbon rated biomass energy, while recycled fibre products tend to be made at mills using natural gas with associated emissions of fossil carbon.

- **Energy efficiency**

Papermaking is fundamentally energy intensive, with energy used to drive equipment and heat to dry the paper. The sector has already delivered huge increases in energy efficiency: since 2006 the total primary energy consumption for the sector has almost halved, from over 24,000 GWh to 12,400 GWh. Within this, the Specific Energy Consumption (primary energy consumed per tonne of paper produced) has reduced from 4.4 to 3.8 MWh/tonne reflecting changed production. With coal long ago replaced by biomass and gas, and sites now grappling with the challenge of replacing natural gas as the primary heat source, there has been significant reductions in emissions: compared with a base year of 1990, direct fuel CO₂ emissions are 69% lower and CO₂ emissions per tonne of paper are 66% lower. The answer to complete decarbonisation is shaping up to be a combination of a number of ideas including electrification, more biomass and biogas, hydrogen, Carbon Capture and of course delivering even more energy efficiency.

Maximising energy efficiency is a moving target as equipment and process efficiency continue to improve. Industry needs long-term support through the energy transition, including capital support for new investments and revenue support where the new energy technology is more expensive to operate than natural gas – especially as competitors outside the UK continue to be encouraged to use natural gas. Government ending support for the Industrial Energy Transformation Fund is especially unhelpful.

- **Water efficiency**

As with all raw materials, papermills have permit requirements to use water efficiently. Sites are required to review and record their water use and review to identify opportunities to improve their efficiency of use. These reviews lead to reduce water use reduction targets per net tonne of production. Additionally, sites are subject to water efficiency audits both from the regulator and through ISO 14001 internal audits.

The water used is generally from boreholes or surface abstracted, with extensive internal reuse

to reduce raw water input. It's also worth stressing that the paper industry is mainly a non-consumptive user of water - the majority of the water abstracted is returned to local rivers – often clearer than when borrowed. Driving water efficiency too far (without valid local reasons) can be counterproductive. It's often the case that mills are located (for historic reasons) in areas of low water stress where there are no shortages of water anyway. Also, if water use is too restricted, it can result in product quality issues and make water treatment more difficult.

- **Process efficiency**

The raw material (pulp) yield in the papermaking process in the UK is already very high (above 85%). Consequently, only limited improvement is technically possible, but it's always a key target for mill operators. Improved efficiency in the paper making process itself has benefits in both material resource usage and in energy saving.

A better controlled, well-engineered and invested papermaking machine will reduce variation in key parameters, especially paper grammage (mass per unit area). Reducing this variation enables a lower grammage target to be set thereby saving raw material. Improved process control and web handling also leads to fewer paper breaks (and so less damaged product to be recycled) as the machine restarts. Fewer breaks also improve the energy efficiency since the machine continues to turn whilst rethreading occurs while the value of the energy used while production is paused is lost. For paper mills with over-capacity, it can be more efficient to run at capacity for shorter periods rather than continuously at reduced speeds. Delivery of better quality feedstock, together with improved process controls, reduces grade change time and so reduced energy and raw material waste. For existing installations, improving heat recovery, and using waste heat either directly within the process or by exporting to other industries or to heat networks are clearly beneficial if they can be economically delivered. Construction of new, faster, wider machines, along with state-of-the-art ancillary systems with heat recovery, inevitably improve energy efficiency and reduce breaks.

- **Alternative fibres**

Wood fibres are used for good reasons – in many locations they are the most appropriate crop to grow, with higher grade timber being used for higher grade uses – such as construction timber and furniture, locking up carbon for long periods of time. Pulp makers take thinnings and lower grade timber providing additional income for forest owners and so supporting long-term forest management.

The industry is always happy to explore new ideas, and as well as maximising levels of recycling, there's

ongoing experimentation with increasing the range of raw materials used in papermaking. A wide range of organic fibres can be used to expand the raw material base. Crops such as cotton or abaca are already used in some products, with straw and bamboo of increasing interest. Wood fibres are used for good reasons – in many locations they are the most appropriate crop to grow, with higher grade timber being used for higher grade uses – such as construction timber and furniture, locking up carbon for long periods of time. Pulp makers take thinnings and lower grade timber providing additional income for forest owners and so supporting long-term forest management.

However the industry is always happy to explore new ideas, and as well as maximising levels of recycling, there's ongoing experimentation with increasing the range of raw materials used in papermaking. A wide range of organic fibres can be used to expand the raw material base. Crops such as cotton or abaca are already used in some products, with straw and bamboo of increasing interest.

- **Lightweighting**

Lightweighting is the process of reducing the weight of the paper or paper-based products while maintaining performance and functionality. Using the corrugated sector as an example, it is a highly efficient and effective packaging solution, with the flexibility to be optimised for a specific product in a specific supply chain. The packaging is designed to limit the void space within the container and maximise the quantity of packages that can be placed onto a pallet, transported in a lorry or container and stored in a warehouse. This efficiency reduces storage space requirements and reduces the number of lorries on the road and energy consumed. The

lightweighting of corrugated further drives these efficiencies, with the benefits of using less material, reducing weight and size of packaging felt throughout the supply chain, enhancing logistics and cutting cost and carbon footprints. However, the industry prefers the term 'rightweighting', recognising that reducing weight must not have unintended consequences. Reducing the weight of the packaging cannot risk its ability to protect the enclosed product. If the packaging fails to protect the product, there will be a detrimental effect on resource efficiency. With innovation and rapidly advancing technology, the paper-based industry has seen the development of stronger and lighter paper and packaging, improving performance whilst the average board weight in the UK between 2004 and 2023 has decreased by 15% - from 528 grams per square meter (gsm) to 447 gsm.

Further Information

Further information is available from Steve Freeman, Executive Director - Energy and Climate Change sfreeman@paper.org.uk.

Confederation of Paper Industries

- The Confederation of Paper Industries (CPI) is the leading trade association representing the UK's Paper-based Industries, comprising paper and board manufacturers and converters, corrugated packaging producers, makers of soft tissue papers, and collectors of paper for recycling.
- CPI represents an industry with an aggregate annual turnover of £15 billion, 56,000 employees, which supports a further 93,000 jobs in the wider economy.
- For facts on the UK's Paper-based Industries please visit: www.paper.org.uk.

REVISED CPI: September 2025