LyondellBasell

Circular by design: unlocking sustainable packaging solutions

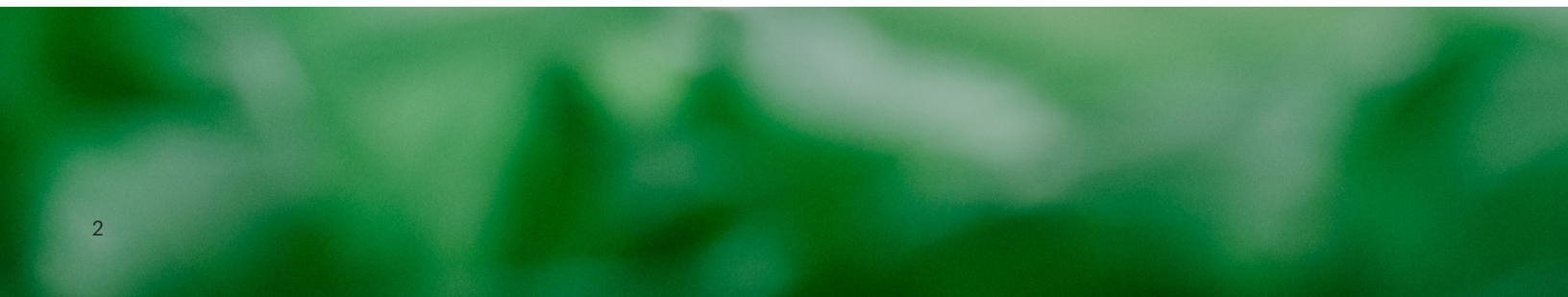
Meeting the global challenge of plastic waste and the opportunity to help build a low-carbon and circular economy requires innovation, investment and collaboration. The ability to recycle plastics in an efficient, effective way is essential to reducing plastic waste. Consumers want it, governments are regulating it, and brands need it. But without smart design, it will be difficult to deliver.

By Jaap Rabou, *Senior Marketing Director, Polyolefins Europe, LyondellBasell (LYB)*

Why design is the starting point

Designing for recycling requires collaboration across the value chain—from material producers to converters and brand owners. It's not a solo effort.

Circularity begins with packaging design. A well-designed package doesn't just look good or function well; it enables recycling, can reduce carbon emissions and supports brands' climate, sustainability and circularity goals. Historically, packaging innovation focused on functionality and efficiency. Today, it must also meet new demands: recyclability, reduced environmental impact and compliance with evolving regulations like the European Union (EU)'s Packaging and Packaging Waste Regulation (PPWR) as well as Extended Producer Responsibility (EPR) schemes across the globe. Brand owners aiming to meet evolving regulatory requirements, respond to shifting consumer expectations, and advance their Scope 3 greenhouse gas reduction goals are turning to packaging solutions that promote circularity and minimize environmental impact.



A practical roadmap to circular packaging

There is no silver bullet to achieve circular packaging design. However, there are several concrete steps that brands and converters can take to reduce the impact and increase the circular potential of their packaging, including:

1. Reducing material use

Switching from rigid to flexible packaging and down-gauging materials decreases the amount of plastic needed to produce a product, thereby reducing emissions and costs.

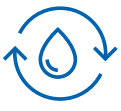
2. Simplifying structures

Moving from multi-material to mono-material packaging improves recyclability by reducing overall complexity of recycling and streamlining input supply. Polyolefins are a preferred choice for this transition due to their functional flexibility and ability to replace other polymers with higher product carbon footprints.

3. Using recycled content

By using recycled content, producers and brands can contribute to circularity and reduce the carbon intensity of their packaging. Depending on the intended use, it's important to select the right type:

- Mechanical recycling, where post-consumer recycled plastics are sorted, shredded, washed and reconstituted; produces resins useful for non-contact sensitive applications such as automotive, industrial uses, luggage, bottles and packaging.
- Chemical recycling breaks down plastic waste to its molecular building blocks, then reintroduces them into the polymer production process as a drop-in feedstock; producing resins useful for highly-regulated applications such as food contact, healthcare, cosmetics and pharma packaging.



4. Switching to bio-circular feedstocks

Replacing fossil-based feedstocks with bio-circular alternatives such as used cooking oil or waste and residual oils provides the flexibility of virgin resin, while reducing the carbon emissions associated with feedstock production, lessening the product carbon footprint.

5. Using renewable energy and finding efficiencies

Powering manufacturing facilities with renewable energy and improving efficiency can further reduce the product carbon footprint.

Traceability is key

When selecting recycled or bio-circular solutions, being able to provide customers, consumers and regulators with evidence that materials are sourced from recycled or bio-circular feedstock is essential. For its chemical recycling (*Circulen*Revive brand) and bio-circular feedstock (*Circulen*Renew brand) solutions, LYB uses an International Sustainability and Carbon Certification (ISCC) PLUS-certified mass balance approach, a voluntary certification scheme designed to validate the sustainability characteristics of alternative feedstocks. This assists in credibly communicating to commercial and individual customers, the public and governmental institutions that companies are complying with clearly defined sustainability standards.

Real-world examples

A strong example is the collaboration between LYB and Bischof+Klein, who are working together to help brands meet circularity and climate targets. The two companies partnered to implement many of these strategies, helping to improve product recyclability and reduce the product carbon footprint of a variety of packages in multiple industries. These examples highlight how collaboration can help customers ideate, develop and implement innovative packaging designs to meet their sustainability goals.

Windshield washer packaging

Bischof+Klein worked with LYB to transition the packaging for a windshield washer solution from a rigid to a flexible container, changing the design to one that relies on a single type of plastic material, increasing recyclability potential. Looking towards the future, they are considering the incorporation of post-consumer recycled resin into future designs, reducing the carbon footprint of the package and aligning with expected future requirements of the PPWR.

Coffee packaging

LYB collaborated with Bischof+Klein to transition a multi-layer coffee pouch package, consisting of layers of PET (polyethylene terephthalate), aluminum and PE (polyethylene) to a solution that had the same multi-layered design, but consisted of a single type of resin (in this case, metalized and non-metalized PE). This cut the product carbon footprint and made a significant improvement in recyclability. In addition to redesigning packaging for recyclability, LYB is working with customers to include resins derived from chemical recycling to help meet future Post-Consumer Recylate (PCR) content requirements for these products.

The cost equation

Sustainable design requires investment—in R&D, equipment and materials, but can also offer savings. EPR fees penalize the use of materials with higher environmental impact, including non-recyclable packaging. The more recyclable the structure, the lower the fees.

To date, there is no uniform interpretation or schedule of EPR fees across the European Union or in the United States. What is clear, however, is that as EPR and PPWR policies progress, those who get ahead of the curve by upgrading their packaging solutions with more responsible options will have a competitive advantage.

Looking ahead

All parts of the value chain play an essential role in innovating the next generation of sustainable packaging. Many of these solutions are available today, while others are emerging. But the path forward is clear:

Start with smart design

Consider simpler designs that reduce material use, improve recyclability, incorporate recycled material and reduce the product carbon footprint, such as using bio-circular feedstock and renewable energy.

Collaborate across the value chain

Brand owners, converters and manufacturers should collaborate to identify solutions to common packaging needs and issues that improve circularity and reduce the carbon intensity of products but maintain the quality and product safety that consumers deserve.

Continuously improve

Leverage innovation, such as LYB Technology Centers across the globe, to identify creative solutions to everyday packaging needs that maintain, or even increase functionality, while reducing emissions and improving circularity.

Circular packaging isn't just a vision, it's within reach. By embracing smart design, using recycled and bio-circular materials and collaborating across the value chain, companies can transform packaging from a waste challenge into a sustainable solution. The tools are here, the initiatives are forming, and the momentum is building. Those who act now won't just meet tomorrow's regulations; they'll lead the market, shape consumer expectations and unlock long-term value. The future of packaging is circular. Let's design it together.

For more information on how LYB can make circular and low carbon solutions work for your business, visit the Circular and Low Carbon Solutions page at lyb.com.

About us

We are LyondellBasell (LYB) – a leader in the global chemical industry creating solutions for everyday sustainable living. Through advanced technology and focused investments, we are enabling a circular and low carbon economy. Across all we do, we aim to unlock value for our customers, investors and society. As one of the world's largest producers of polymers and a leader in polyolefin technologies, we develop, manufacture and market high-quality and innovative products for applications ranging from sustainable transportation and food safety to clean water and quality healthcare. For more information, please visit www.lyb.com or follow @LyondellBasell on LinkedIn.

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