

Position on mass balance in chemical recycling



Our industry and company have embarked on an important journey toward helping to end plastic pollution. LYB is a founding member of The Alliance to End Plastic Waste¹, a member of the Ellen MacArthur Foundation² and our work in support of a Global Plastics Treaty³ demonstrates leadership and ongoing commitment to address this global challenge.

LYB believes all plastics recycling and low-carbon technologies have a role to play in the chemical industry's transition towards a net-zero and more circular future. For this reason, we are investing in a number of promising recycling technologies: mechanical, chemical and solvent-based recycling.

LYB believes chemical recycling will be a key enabler of our industry's transition, as it allows plastic waste streams that cannot be effectively addressed through mechanical recycling to be converted back into feedstocks for plastic manufacturing, thereby displacing the use of virgin fossil resources. In addition, with chemical recycling, we will be able to produce more plastics that can be used in highly regulated applications such as food contact, medical applications and high-performance materials. Further, chemical recycling can be integrated with existing petrochemical assets, thus leveraging current infrastructure to co-process both chemically recycled and virgin fossil feedstocks. This integration enables faster scale-up of recycling capacity and avoids the environmental impacts associated with building out new, stand-alone infrastructure for producing plastics solely from recycled waste.

Given the promise of chemical recycling, LYB has developed *MoReTec*, our own differential, proprietary catalytic chemical recycling technology. *MoReTec* is a technology characterized by a reduced carbon footprint, high plastic-to-plastic yields and improved scalability compared to traditional pyrolysis technologies.

Industrial scale-up and investment in chemical recycling requires a supportive legislative and regulatory framework in the U.S., Europe and beyond. This framework should recognize that the most efficient, sustainable and economically viable way to boost the circular economy is to leverage existing large-scale cracker and polymer facilities and associated infrastructure for the production of new plastics to co-process chemically recycled feedstock together with fossil-based feedstock, using a credible mass-balance approach to attribute recycled content to end-products.⁴ Supportive legislative and regulatory frameworks should ensure the attribution of recycled content through mass balance is done in a consistent and transparent way, and third-party certification schemes are utilized to ensure transparency and credibility of the system.

LYB believes that the "fuel-use excluded" mass balance approach is the best long-term solution as it incentivizes higher material-to-material yields from recycling and levels the playing field for recycling technologies to compete based on how efficiently they produce material that can be transformed into recycled content.⁵ The fuel-use excluded mass balance approach is more stringent than "free-attribution" mass balance, which allows fuel outputs to be counted when calculating recycled content credits. By contrast, fuel-use excluded approaches ensure that only materials produced by the process, and no energy or fuel outputs, are counted towards the generation of recycled content credits. Consistent with this approach, LYB supports robust, third-party certification programs, such as ISCC PLUS, and transparent tracking and auditing to ensure that only material-to-material outputs are eligible for attribution towards recycled content claims.



We believe this approach will provide the clarity and credibility needed for effective program implementation and stakeholder confidence. Credible sustainability claims can then be made without physically segregating recycled content, similar to other mass-balanced products, such as renewable energy.

There is already legislative support for the fuel-use excluded mass balance approach. Europe and a number of U.S. states, such as California and Colorado, are prioritizing material-to-material recycling and are actively engaged in setting policy and regulations defining recycling, extended producer responsibility, the concepts of mass balance and attribution of recycled content credits. LYB will continue to advocate for workable, science-based regulatory approaches to exclude energy and fuels from recycling credit attribution systems.

LYB also recognizes there is currently a place for free-attribution mass balance practices as they support the diversion of plastic waste from the environment, and increase the amount of recycled content available, enabling faster scale up during the transitional period to a more circular economy. However, we believe that in the long term, a free-attribution mass balance system for chemical recycling will face increasing risk and a lack of credibility with regulators and the public as many regions of the world move toward a mass balance system that emphasizes material-to-material inputs and outputs. This shift is expected to differentially increase demand for fuel-use excluded recycled content versus free-attribution, particularly in applications where circularity and transparency are more highly valued.

Question: What are the advantages of fuel-use excluded vs. free-attribution approaches?

Answer: A fuel-use excluded approach makes it more valuable to turn recycled inputs into materials rather than fuel, thereby incentivizing the development of new and innovative recycling technologies. Allocating credits from fuels in a free-attribution approach removes the incentive to boost material yields and also disincentivizes the development of novel recycling technologies.

Fuel-use excluded approaches boost value-chain confidence in attributing recycled content and enable robust responses to criticisms raised in greenwashing litigation about the credibility of content claims. Elevated confidence in the overall system and accountability may also drive investment in innovative recycling assets globally.

Crediting only material outputs prevents an unfair advantage for lower-yield chemical recycling processes by avoiding incentives for turning recycled content into fuel. This approach helps ensure that systems are optimized for material-to-material outcomes, maximizing overall circularity.

Question: What is the LYB position on the free-attribution approach to mass balance?

Answer: Free attribution may be necessary in the early stages of market development for chemically recycled products to help support the profitability of investments in chemical recycling prior to reaching economies of scale, and to increase the availability of recycled products to support increased market adoption. However, over time, free attribution presents limitations, including reduced traceability and credibility in the eyes of the public⁶, potential regulatory skepticism as accounting frameworks evolve, consumer confusion regarding materials circularity and increased reputational risk.

1. <https://www.endplasticwaste.org/>

2. <https://www.ellenmacarthurfoundation.org/topics/plastics/who-we-work-with>

3. <https://www.lyondellbasell.com/492c8b/globalassets/sustainability/united-nations-plastics-agreement.pdf>

4. Mass balance accounting is a well-established set of bookkeeping principles used to track the quantity of certified or sustainable raw material (in this case recycled content) that enters the production system, apply a conversion factor to determine the amount of material that is available to be attributed to outputs from the process considering production losses (sometimes called generating a "recycled content credit"), and then accurately account for the attribution of credits to final products to ensure the amount of content attributed does not exceed the amount of content put into the system.

5. In this model, the conversion factor used to calculate the share of input from recycled feedstock that can be attributed to outputs from the production process discounts for process losses and fuel produced during each production step.

6. Due to the potential for disproportionate recycled content attribution, particularly where significant portions of outputs are used as fuels.

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](https://www.linkedin.com/company/lyondellbasell) on LinkedIn.