

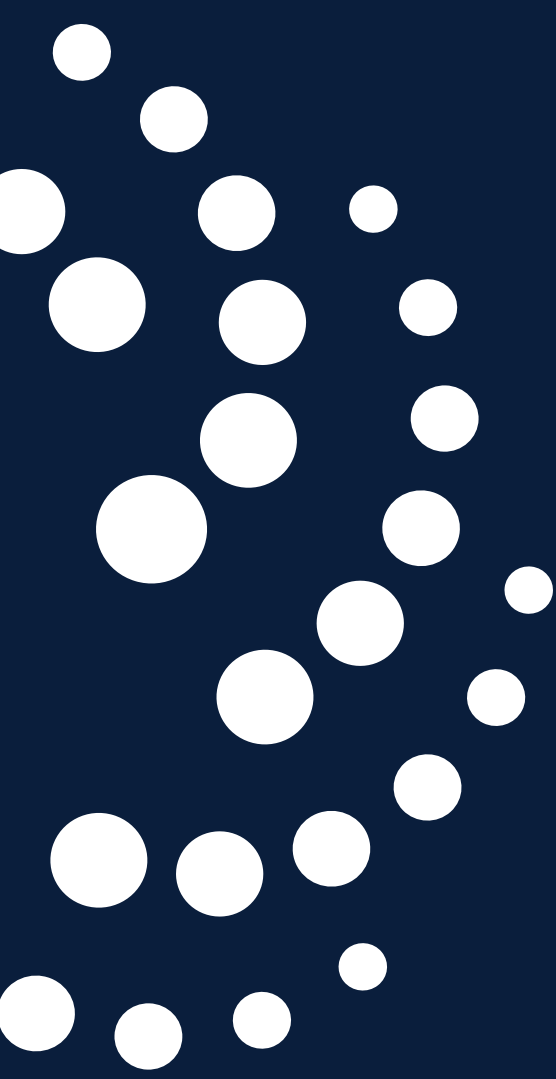
Overcoming plastic “bottlenecks” in the circular economy



**Energy
Beyond
Limits**

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01

Introduction: Role of plastic bottles in a circular economy

The pressure is on to accelerate circular economy solutions so that future generations will have sufficient resources for survival. Based on 2021 consumption levels, sustaining the world's current economic growth trajectory requires ecological resources of 2.3 planets by 2050, according to the World Business Council for Sustainable Development.

To address this crisis, many businesses, governments and consumers are looking to transition towards the use of renewable energy and resources, eliminate the use of toxic chemicals and significantly reduce waste.

As a global energy company with a strong focus on sustainability, OQ actively supports the packaging industry's efforts to supply more eco-friendly packaging formats that can be recycled and reused to reduce plastic waste. It is critical to close the "circularity gap": about 100 billion tons of materials are used by the global economy every year, but only 8.6% are recycled or reused – a massive 91% gap.

One packaging that has gotten significant attention is plastic bottles. Some may misconstrue that plastic bottles impede the circular

economy, which involves sharing, reusing, repurposing and recycling existing materials to minimise waste. This is because 1.4 billion bottles end up in landfills, are burned or are tossed out every year.

On the contrary, plastic bottles can have an important role to play in the circular economy as they are easily recyclable and can be a versatile material to reuse. The real challenge lies in getting consumers and brand owners to apply the 3Rs of a circular economy – "Reduce, Reuse, Recycle" – to minimise waste and maximise the lifespan of plastic bottles.

At OQ, we are committed to partnering with the packaging industry to explore ways to apply these "Three R's" to plastic packaging solutions, while expanding our range of quality polymer solutions to support the needs of our customers.

This white paper examines ways to remove the obstacles – or bottlenecks – of plastic bottles in the circular economy, and how the proper and innovative use of this packaging material can enhance its role in the circular economy of the future.



02

Bottlenecks caused by a linear "take-make-waste model"

Most plastic materials are still currently stuck in a linear "take-make-waste model", where producers take oil resources to make plastic products, which are then discarded by consumers, often after a single use.

This linear model gives rise to three bottlenecks in a circular economy for plastic:

Inefficient design

A significant proportion of plastic bottles made with virgin feedstock are designed for single use and thus discarded, which is a waste of resources. Other bottles are unnecessarily overdesigned and heavy, which can be reduced by using a combination of innovative polymers and improved designs.

The world uses about 1.2 million plastic bottles per minute in total. However, about 91 percent of plastic is not recycled. Roughly half of our global annual plastic production is destined for a single-use product.

Low plastic recycling rates

In the United States, less than 5 percent of plastic bottles which are

made with monomers are recycled. In China, which until recently was a big importer of plastic waste, the rate is less than 33 percent. Most plastics are recyclable, but in practice, recycling rates are low for many reasons, including:

- Plastic bottles may be contaminated by food or other substances, so the resins are not clean enough to be recycled or reused.
- Recycling facilities need significant scale to sort different kinds and grades of plastic polymers and to recycle them in a cost-efficient manner. But in many locations, these facilities lack the critical mass to operate economically.
- Collection rates of plastic bottles for recycling diverge widely, with rates as high as 60 percent in parts of Europe and almost no basic plastic waste collection systems in some less developed African and Asian countries.

High amount of plastic bottle trash

One key element of a circular economy for plastic is minimising leakage of plastic into the environment. However, the majority of plastic bottles – as much as 80 percent – end up in landfills and incinerators. These bottles are thrown away even though they are of sufficiently good quality to be re-used or repurposed in order to extend their lifespan.



03

3Rs: Key steps to overcome bottlenecks

Here are three solutions to the above-mentioned bottlenecks in the circular economy:

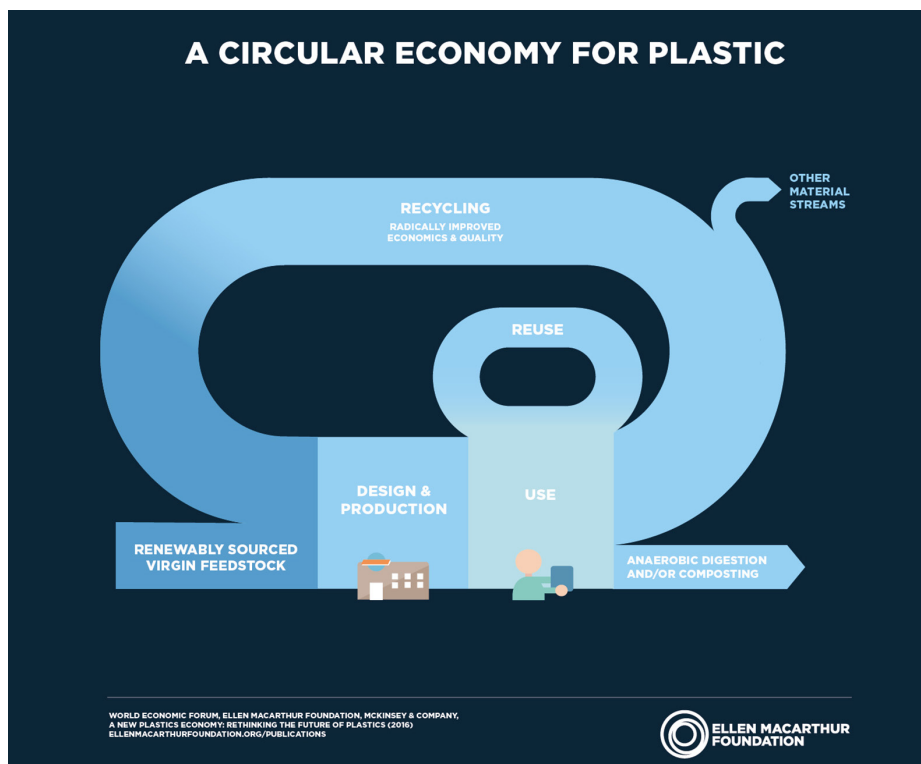
1. **Reduce:** Minimise use of plastic to avoid waste
2. **Recycle:** Increase recycling, upcycling and downcycling to make other products
3. **Reuse:** Extend the lifespan of plastic bottles

REDUCE: Minimise use of plastic to avoid waste

Use lightweight, thin-walled plastic bottles

By rethinking how we design packaging products to reduce the amount of virgin plastic use, we can make a huge difference across an entire product range. For instance,, brand owners like Dove cut the weight of their packaging by a fifth through better and lighter packaging designs like soft soap dispensers and skincare bottles.

OQ's quality Luban resins are designed to produce a wide range of blow-moulded containers as well as thin-walled bottles, which are designed to minimise the amount of plastic used. We are continually working with converters and industry players to find ways to produce even more durable yet thinner materials for bottles.



Source: *Plastics and the circular economy* (ellenmacarthurfoundation.org)

One example is the food and beverage industry. Our Luban DMDH-6400 is able to produce food grade plastic bottles that are relatively lightweight and thin-walled, reducing the amount of plastic used while still providing the high stiffness and barrier protection

needed to keep beverages like milk fresh for a longer time. This Luban grade is also made with Polyethylene HDPE, which is widely accepted at most recycling centres as it is one of the easiest plastic polymers to recycle.



Design durable bottles to hold ultra-concentrated products

Some companies are reducing the amount of liquid products by offering ultra-concentrated formulas that provide many more dosages for the same volume of liquid. Concentrated refills can also yield considerable material savings. For instance, a concentrated refill of Unilever's Lifebuoy hand soap can reduce the use of plastic materials

by up to 75 percent.

Other companies are packaging concentrated sauces or beverages that can be diluted with water according to the consumer's personal taste.

To hold these ultra-concentrated formulas or sauces and beverages, the bottles must be durable, have impact strength and higher resistance to the ultra-concentrated contents. OQ's Luban DMDA-6200 is a Polyethylene HDPE used in HIC

bottles that not only offer benefits like stiffness and impact strength, but also have superior surface finish to improve aesthetics.

Our Luban DMDZ 6147 is also able to provide the stress cracking resistance and durability needed for the plastic bottle to withstand the higher concentrations of chemical products. Such qualities are particularly important in industrial, agricultural and chemical applications.



RECYCLE: Increase recycling, upcycling and downcycling to make other products

Plastic bottles can easily become a foundational item in a circular economy. As they tend to be made with one single material, they are relatively easier and cheaper to recycle compared to multi-layer packaging materials that are harder to separate into different recycling streams.

Improving recycling rates also requires increasing collection rates of plastic bottles from communities to ensure critical mass for recycling centres to operate economically. On this front, governments play an important role by setting up the right infrastructure and enacting policies that either mandate or incentivise consumers to keep plastic bottles within the circular economy.

Consumers are critical too. They can put pressure on brand owners to use more recycled plastics in

bottles, even if using renewably sourced feedstock may sometimes be less cost-effective than using virgin feedstock due to technical issues. They can also take matters into their own hands, by converting discarded plastic bottles into either equal or greater value products – known as “upcycling” – through creative ways such as repurposing a disposable water bottle into an indoor terrarium or a watering container.

There is also a growing industry for “downcycling” plastic bottles

into lower grade products such as carpet fibres or non-food containers.

All these examples are part of incorporating post-consumer recycling plastic content into non-food products. OQ's Luban DMDZ 6147 grade has relatively high environmental stress crack resistance (ESCR) and impact resistance which can potentially balance variations in mechanical performance due to Post Consumer Recycle (PCR) quality consistency.

A case in point is Polypropylene (PP), a versatile polymer and one of the most widely used materials in packaging for food and beverages. But it is not widely recycled for its same original function as it is difficult to separate food-grade PP from non food-grade PP. It can, however, still be recycled into non-food packaging applications such as crates, planter boxes or toy bins.

REUSE: Extend the lifespan of plastic bottles

There are many ways that consumers can reuse the same bottles for the same original purpose, or for different functions.

For instance, brand owners are selling durable, ergonomically designed clear detergent bottles that are designed to encourage refills. OQ's Luban RP7204G used to design durable bottling solutions with high impact strength. It also supports the important feature of transparency and clarity needed for a refillable plastic detergent bottle.

This way, consumers can easily see how much liquid is left and when they need to buy refills to top up the bottle. Brand owners also design refill bottles with markers to remind consumers to top up, as well as child-proof caps to ensure that the bottles are safely used in a household.



Promote bulk purchases for refilling

Another way of extending the lifespan of bottles is to use refills. This cuts down the use of single-use bottles as well as small-sized bottles that are commonly discarded once the contents are used up.

Research has found that a 10 percent increase in the share of beverages sold in refillable bottles could result in a 22 percent decrease in marine plastic bottle pollution. This would keep 4.5 to 7.6 billion plastic bottles out of the ocean each year.

The bulk refill products are typically packaged in much more durable, tough plastic bottles that are designed for ergonomic handling despite their larger weight and size.

For other products commonly sold in bulk such as fertiliser, our Luban DMDZ-6147 can be used in jerry cans that are durable and have high environmental stress crack resistance (of more than 1000 hours) for more aggressive chemicals. They also have high impact resistance to enable them to be transported easily and safely despite their bulkier format.



04

Promote Consumer and Corporate Change to Minimise Plastic Waste

Promote Consumer and Corporate Change to Minimise Plastic Waste

The 3Rs – Reduce, Recycle and Reuse – can go a long way to resolve the bottlenecks by minimising the amount of plastic that end up in landfills, incinerators and trash. But system-wide change -- from influencing consumer behaviour and

attitudes about the use of bottles to changing the way companies make bottling solutions – are also needed for the 3Rs to be truly effective. There is much to do and a long way to go before plastic bottles can become a significant contributor to a sustainable, circular economy. More importantly, consumers, brands and packaging producers should transform their mindsets to break out of the traditional “take-

make-waste” model.

OQ offers solutions to the packaging industry, enabling them to make this critical transition to sustainability. Besides providing quality packaging solutions that contribute to closing the loop, we are also spreading the word about the importance of advancing plastic bottles’ role in the circular economy.



**Rather than writing
off all plastic bottles
as pollutants, creative
rethinking will ensure
that they can become
a bigger, better part of
the circular economy.**



For commercial enquiries,
contact us at [https://connect.
oq.com/polymers-inquiry](https://connect.oq.com/polymers-inquiry)
or scan the QR code

