



Solving the plastics challenge together

Why we need to join forces
to make plastic more sustainable

NESTE

A circular and renewable plastics economy is possible

Plastics are versatile materials that make things better in many ways, from keeping food fresh to enabling mobile and battery technology. They are part of the complex value chains that underpin our lives – and behind most of the life-saving advances of modern medicine.

At the same time, poorly managed plastic waste is choking the world's oceans, piling up in landfill, polluting the planet and putting people and wildlife at risk. Around 500 billion disposable plastic bottles are made every year¹, each of which takes 450 years to decompose². Plastic pollution has come to be viewed as one of the greatest symbols of the negative impact the human species is having on the environment.

Plastic also contributes to climate change. Most of it is made from fossil resources and around 20% is incinerated at end of life³, which releases the carbon back into the atmosphere.

From fossil-based to renewable and recycled

So is there a way to keep the benefits of plastic while protecting the environment?

Technologies exist that can replace the fossil resources in plastic with renewable and recycled materials. Through new recycling technologies, more material could be kept circulating in the loop, reducing the need for virgin plastic production, fossil resources, landfill and incineration, as well as turning waste plastic into a valuable resource – all while also drastically reducing the carbon impact.

Along with a more environmentally-conscious approach to how we use and reuse plastic, these changes, if adopted, could be transformative on a global scale. But progress towards this transition is still too slow and tentative.

The need for concerted action

This white paper from Neste looks at the problems with plastic, the potential solutions, the business opportunities in a circular and renewable future, and how to overcome the barriers to change. As one company among many, we understand that real change is hard to achieve alone. That is why we are inviting companies, consumers, and regulators to join us on this journey – to move the dial on the chemicals and polymers industry from being seen as part of the problem to integral to the solution.

Plastics: the good, the bad and the ugly

1.15 trillion

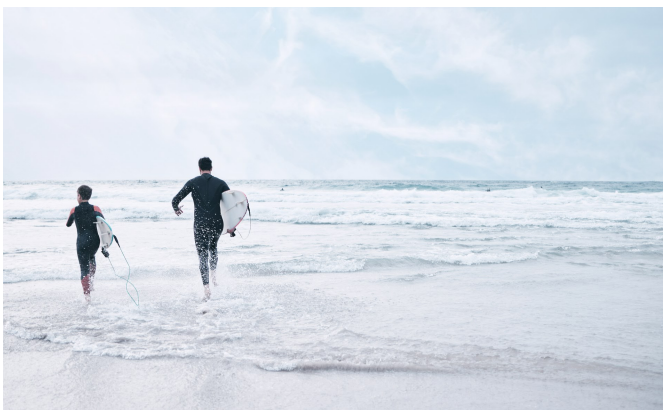
microchips made using plastic 2021⁴

5 trillion

plastic bags used worldwide every year⁵

98%

of single-use plastic products are produced from fossil fuel⁶



1. [Habits of waste](#)

2. [WWF Australia The Lifecycle of Plastics](#)

3. [OECD \(2022\), Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options, OECD Publishing, Paris](#)

4. [World Semiconductor Trade Statistics organization](#)

5. [The World Counts](#)

6. [Plastic Waste Makers Index](#)

The goalposts are moving: we need to act now

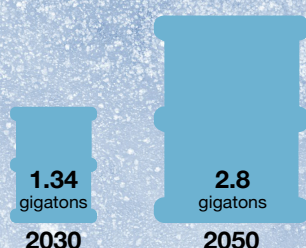
Despite ongoing efforts to recycle plastic and reduce its fossil content, it is still not happening at scale. Less than 10% of all plastic waste is currently recycled, with the majority going to incineration or landfill⁷.

The vast majority of production is still virgin plastic, made from fossil resources that contribute to carbon emissions. Plastic is on track to make up 20% of global oil and gas consumption by 2050⁸.

A large majority of plastic items are single-use, adding to the growing volumes of waste. Out of more than 9 billion tonnes of plastic produced since 1950, around 7 billion tonnes has ended up as waste⁹.

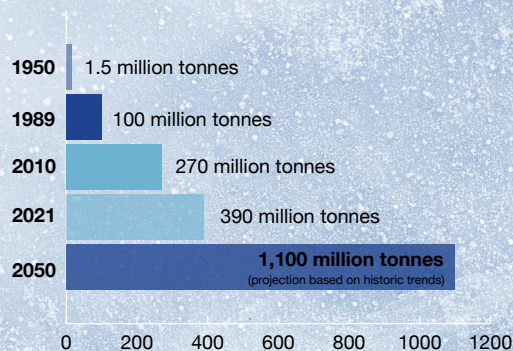
That volume can be expected to multiply as global demand for plastic is projected to increase dramatically in future decades. Based on historic trends, primary plastic production is forecast to almost triple, from 390 million tonnes a year today to 1.1 billion tonnes a year by 2050¹⁰.

It is a big contributor to global emissions



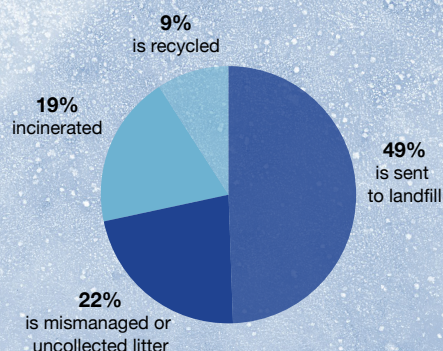
Source: Plastics and Climate: the hidden cost of a plastic planet. Center for International Environmental Law, 2019

Global demand for plastic is growing exponentially



Sources: Statista; UN Environment Programme

Most of global plastic waste is going to landfill or incineration



Source: OECD

7. OECD (2022), Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options, OECD Publishing, Paris

8. Center for International Environmental Law (CIEL) Fueling Plastics: fossils, plastics and petrochemical feedstocks

9. UN Environment Programme Law and Environmental Assistance Programme Plastic Pollution Toolkit

10. UN Environment Programme Beat Plastic Pollution

Calls for change are growing

Increasing evidence of the impact of plastic waste on oceans, ecosystems, food chains, and climate change are ringing alarm bells. Environmental campaigners, governments and policymakers are looking for ways to limit the impact, while consumers and brands are also taking more of a stand.

Regulators: governments are developing initiatives to promote non-fossil content in plastics and increase the usage of sustainable and responsible raw materials. In 2022, 175 countries backed a ground-breaking UN resolution to stop plastic pollution. This is expected to result in a legally binding, international agreement by the end of 2024, aiming to make plastics more sustainable¹¹. Meanwhile the EU is setting up product-level sustainability requirements for plastics including mandatory recycled content. Plastics are also part of the European Green Deal that sets a roadmap for becoming climate- neutral by 2050.

Consumers: research shows that more and more consumers want to find more circular and renewable options where possible. GWI's global Zeitgeist Study in 2022 showed that 56% of consumers are trying to cut their use of plastic packaging¹². A recent survey by the University of Pennsylvania in the U.S. showed nearly 90% of Gen X consumers said that they would be willing to spend an extra 10% for sustainable products¹³.

Major brands: brand owners are recognising the change in consumer behaviour. More large companies are pledging to reduce plastic content and pollution, for example by increasing their use of renewable and recycled packaging, or reducing their dependence on virgin fossil materials. Many are also making ambitious pledges to cut their Scope 3 emissions, including from plastics, and increase circularity. This accountability will continue to grow as social and governmental pressure to reduce carbon and plastic waste increases.



11. UN Environment Programme Intergovernmental Programme on Plastic Pollution

12. Connecting the Dots: 2022's biggest consumer trends

13. First Insight white paper The Sustainability Disconnect Between Consumers and Retail Executives

The solutions exist but they need to be adopted at scale

Reducing our use of plastics, particularly in packaging and single-use items, is essential – as is moving away from our throwaway culture to one that is focused on reuse and recycling. That means increasing the volumes of plastic waste recycled by current methods and curbing the growth of single-use plastic applications.

But those changes will not be enough to solve the problems caused by plastics on their own. There are still significant barriers – for example, many of the plastic products made today are not recyclable in practice. In addition to the existing solutions, new recycling technologies can also increase circularity.

To achieve change at the scale that is needed, the industry needs to embrace a wider range of solutions and technologies.

Accelerating the move to more sustainable plastic

Rapid advances in recent years have brought a range of transformative technologies into play. For example, using renewable materials such as biomass to produce polymers, or breaking down waste plastics into hydrocarbon molecules that can be used to make virgin quality plastic that can be recycled again and again. In the future, it may even be possible to extract

atmospheric CO₂ and use it in combination with hydrogen as a resource for plastics.

The industry needs to adopt and develop these technologies at a much faster rate.

Delays pose risk for reputation and bottom line

Many companies in the chemicals and polymers industry, including Neste, are developing solutions. Yet, given the scale of the problem, some feel the industry is not acting with appropriate urgency, or with the coordination, planning and idea sharing needed to make a sea change. A delay in decisive action bears the risk of losing the social license to operate.

Delays may also strengthen the perception of businesses prioritizing profits over change and benefits for the society. If the industry is not seen to be taking responsibility for what goes into its products and for what happens to them through their life cycle, claims that are being made about the advances are being undermined and could lead to accusations of greenwashing.

The sooner we act the better, both for the sake of the planet and for the future of the industry.



What are the solutions?



Sustainable design

Design plastic items considering material efficiency, reusability and recyclability. Reduce, reuse, refurbish and repair whenever sustainable alternatives are available.



Recycle using conventional methods

Mechanical recycling: process plastic waste into new plastic by mechanical means without changing its chemical structure.



Rethink recycling to close the materials loop

Chemical recycling: break down existing plastics at a molecular level, so they can be reused to make virgin quality plastic time and time again. It can enable recycling of difficult waste such as single-use packaging and supply recycled plastic for demanding applications such as food packaging and medical devices.



Make plastics from renewable sources

Bio-based plastics: make plastics from sustainably sourced waste and residue oils and fats, woody biomass and renewable plant-based feedstocks such as corn and sugar cane, providing a real alternative to fossil-based raw materials. Drop-in biobased plastics allow maintaining the same quality and performance than conventional plastics, without compromising on safety, durability and recyclability.

Find out more about sustainable plastics

Seizing the opportunity through early adoption

To solve the plastic challenge on a global scale, everyone needs to play their part. Governments and regulators need to create a level playing field, incentivise the shift away from virgin fossil resources. Brand owners need to be open to change and new technologies. Consumers need to vote with their wallets and embrace sustainable solutions.

The chemicals and polymers industry is in a unique position. It can lead the change that is needed by showing what is possible. The sector has the solutions and technologies in its hands today that can accelerate innovation and develop new greener business models.

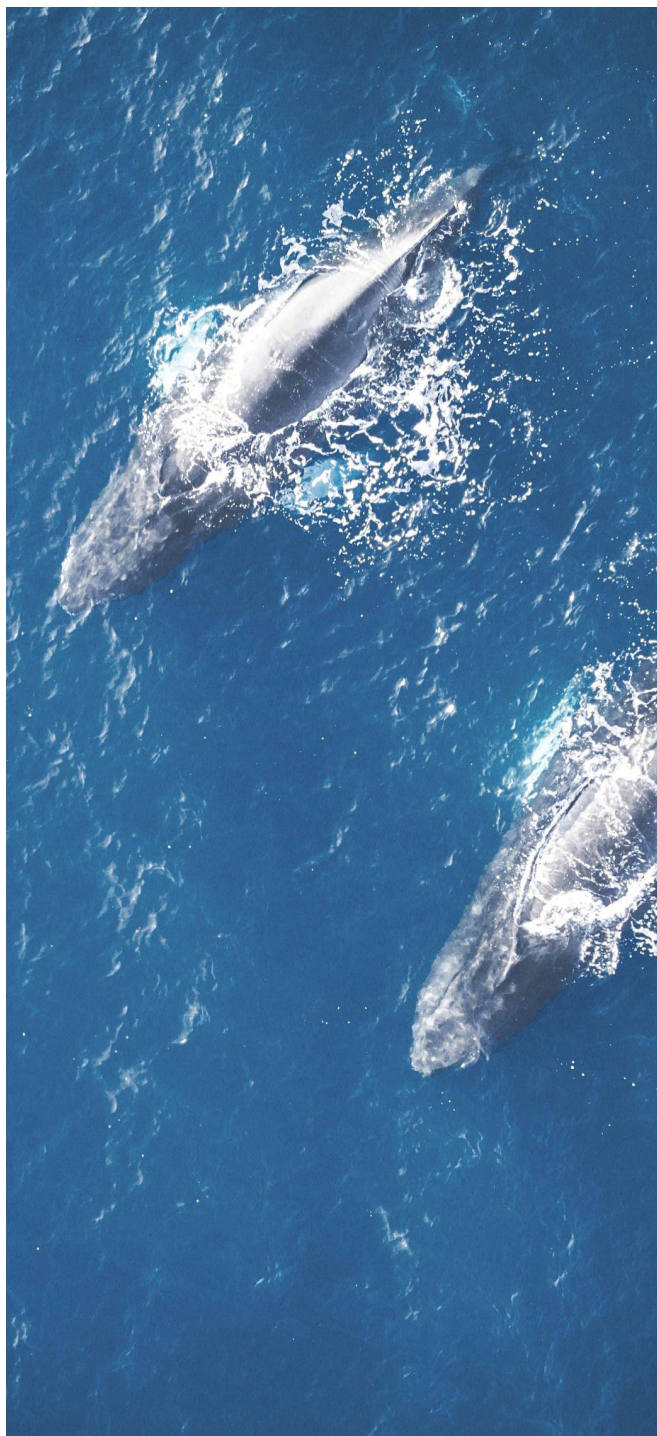
By acting now, the industry can:

- seize an enormous business opportunity by developing the plastics that everyone will want in the future.
- shift supplies of raw materials and feedstocks away from fossil sources, which are in decline and may be restricted over time.
- increase traceability of raw materials throughout the product life cycle and across the value chain – helping to reinforce sustainability claims and get ahead of regulations coming down the road.
- reduce the carbon footprint in plastics and their overall climate impact.

The scale of the business opportunity

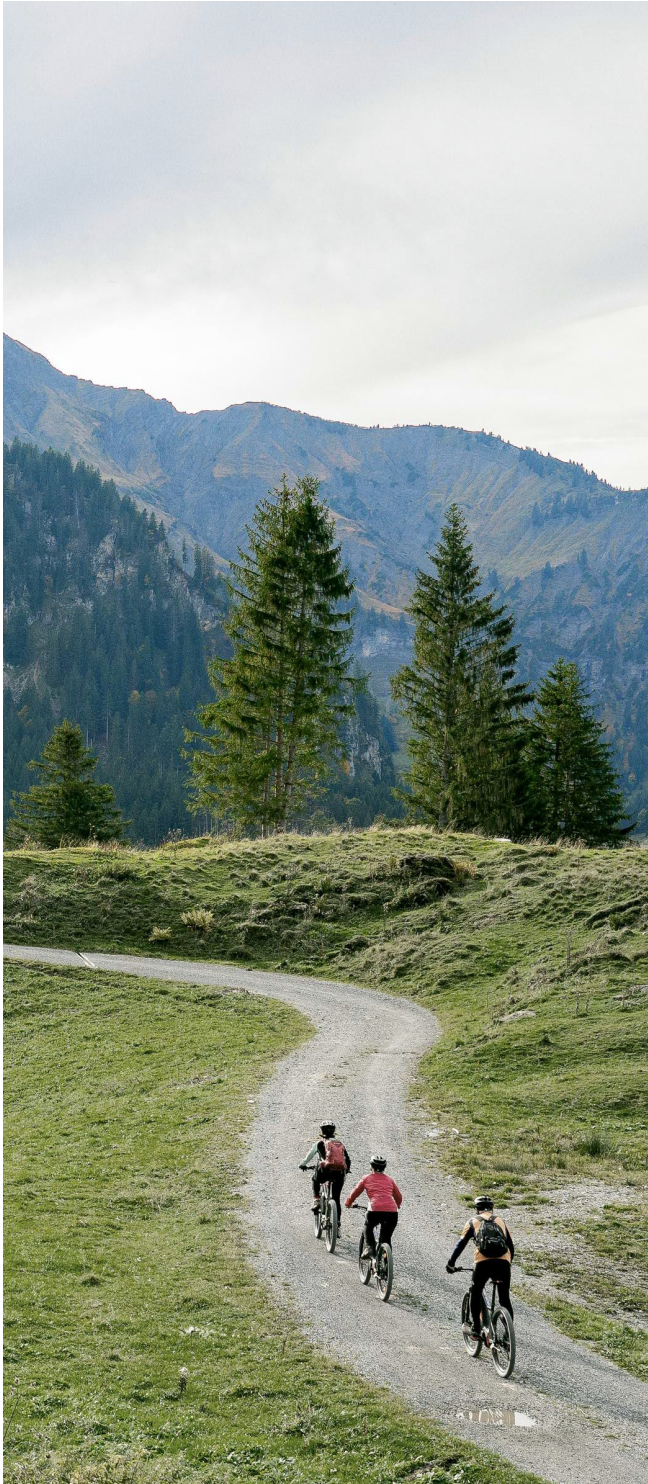
Moving towards circular and renewable plastics now makes business sense. The global market for bioplastics alone is expected to grow from \$12.4 billion in 2022 to around \$63.5 billion by 2032, a compound annual growth rate (CAGR) of 17.8%¹⁴, while the market value of plastic recycling is set to almost double from \$39.6 billion in 2021 to \$77.8 billion in 2031¹⁵.

Early adopter companies that invest in these technologies today will stand to gain the greatest advantage as they become the industry norm.



14. Precedence Research: Bioplastics market forecast

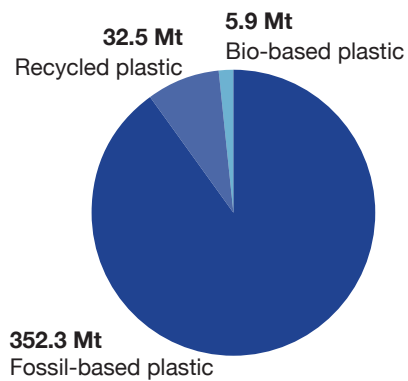
15. Statista: Market value of plastic recycling worldwide from 2021 to 2031



Research suggests consumers are more likely to support businesses that show environmental responsibility – a 2023 study by McKinsey shows products making ESG-related claims had greater cumulative growth over the past five-years compared to products that did not¹⁶.

Change will also bring opportunities and benefits throughout the value chain, from creating a stable market for renewable feedstock crops to supporting reuse and repair business models and sorting and recycling infrastructure.

Plastic production in 2021 (in million tonnes)



The potential market is huge: recycled and bio-based plastics make up less than 10% of current production.

The cost of not acting

As time goes on, companies will come under increasing pressure to defossilise and take responsibility for how they source raw materials through the supply chain and for what happens to products at end of life. These longer-term and hidden costs are not captured in short-term price calculations.

Earning a voice in regulatory decisions

Showing leadership through early adoption of circular and renewable solutions may also help the sector gain some influence on the shape of regulatory frameworks in areas such as product life-cycle and end-of-life regulation, as well as pathways for industry transformation.

16. McKinsey and Company: Consumers do care about sustainability – and back it up with their wallets

What is needed: more collaboration across the value chain

Making change at the scale that is needed requires more exchange, trust, and transparency. Competition remains important as a driver of innovation and transformation. But it can also hold back development at an industry and global level. Collaboration and co-creation are essential.

For a very long time, the mantra of the polymers and chemicals industry has been every person for himself - and it worked quite well. However, going forward and to meet corporate and societal targets, this won't be enough anymore. It will take a joint effort to accelerate the transformation.

Through collaboration, risks can be shared and reduced. Best practices can be shared, and everyone can learn from each other. This will not only help us move towards a circular plastics economy and reduce

climate impacts – it can bring real and lasting benefits for all the businesses involved.

Creating win-win situations

The change that is needed is on a scale that cannot be achieved by individual companies acting alone – it needs joint ventures and partnerships. By joining forces and sharing ideas, partners can advance new technologies and ramp up capacity more quickly. Everyone can gain from accelerated innovation and sustainability improvements in the longer term.

The advances made by the industry working as a whole will far outstrip those businesses can achieve individually. It can create win-win situations where by helping others, you also increase your own competitiveness. In this respect, cooperation and competition are not contradictory.

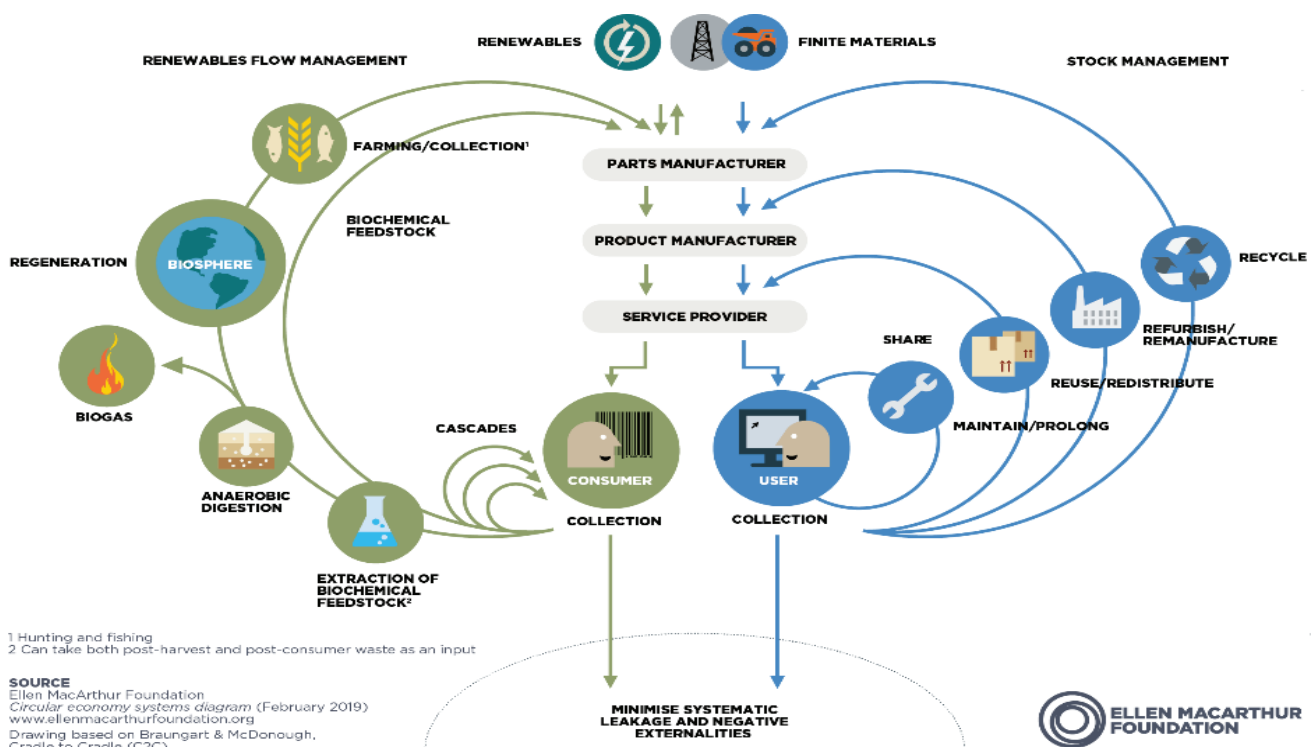


Thinking more circular, less linear

The industry needs to go beyond linear supplier-company-customer relationships and consider a wider range of stakeholders and longer-term life cycle impacts. To gain the deepest benefits from collaboration, businesses must engage more with companies and industries with which they do not have direct business relationships, but which are part of the same circular economy.

That means being open to new things: for example, taking a step toward waste management so that waste materials can be recovered, moving closer to genuinely closed material cycles. It is important to understand all parties who are part of the value chain from polymerisation to cracking, from waste managers to brand owners. What are their goals and needs? And how can they break down barriers to collaboration?

An illustration of the continuous flow of materials in a circular economy, maintained by cross-industry collaboration.



Source: Ellen MacArthur Foundation

Collaboration in action: case studies

Increasing trust in mass balancing certification through digital supply chain tracking system

A total of 10 chemicals and polymers companies came together with International Sustainability and Carbon Certification (ISCC) and sustainability software platform Circularise in a joint project that has increased the integrity of mass balancing certification for everyone in the industry.

Mass balancing is a system that allows manufacturers in a multi-tiered supply chain to achieve measurable and traceable sustainability from source to products. The 10 companies collaborated to test a new blockchain system that makes it simple and more efficient to audit businesses, while also strengthening the integrity of certified data, increasing trust in the certification process.

Replacing fossil raw materials with renewables

Polycarbonate and polyurethane manufacturer Covestro is replacing some of its fossil raw materials with renewable alternatives in a collaboration with Neste RE™ and its partners Borealis and SK geocentric.

As a result of the joint project:

- Covestro's high performance polycarbonate, which is used to manufacture car headlights, LED lights and electronic devices, is now produced with part-renewable phenol.
- The company's rigid polyurethane foam, which is used as insulation to help save CO₂ emissions and reduce energy consumption, can now be manufactured using part-renewable benzene.

"We are helping important industrial sectors such as the automotive and electronics industries achieve greater sustainability and reduce the dependence on crude oil. By cooperating with upstream partners, we are showing how a sustainable value chain can work."

COVESTRO

Making McDonald's plastic cups more sustainable

Neste RE™ works with a range of industry partners to support McDonald's clear cups pilot program, providing renewable feedstocks for test cup manufacture.

The test cups are made from post consumer plastic material and biobased materials on a mass balance method, including McDonald's used cooking oil. This test is one of many steps that will help McDonald's meet its goal of sourcing 100% of guest packaging from renewable, recycled, or certified sources by 2025.

"We know that sustainable sourcing solutions are a team effort – and this test is no exception. Our friends at TMS-HAVI helped organise this effort from the very beginning by engaging with industry leaders Pactiv Evergreen, Neste, INEOS and LyondellBasell. Each partner provided a piece of the puzzle that made this test possible."

MCDONALD'S

Conclusion: let's work together to make it happen

For all their amazing properties and uses, plastics have become a bad news story. And on current trajectories, with production, waste and carbon impacts continuing to rise, the public perception of plastics is only going to get worse.

The chemicals and polymers industry has solutions at hand that could make plastics more sustainable and change some of those negative stories into positive ones.

It can be part of the transition to a circular economy by producing plastics from renewable and recycled materials and making it possible to recycle them more often, creating a closed materials loop with less plastic waste.

But the sector needs bolder action to get there. Companies need to think more circular, less linear. To solve the global plastics crisis demands a new level of ambition. A willingness to embrace new technologies, collaborate and share ideas and data, and work with partners outside the industry, to accelerate progress at the speed and scale that is needed.

Neste is committed to making this transition. We are open to partnering and working with anyone who shares our aim to create a sustainable future for plastic. We would love to welcome you on the journey.



NESTE

Change runs on renewables

