

## Circular economy

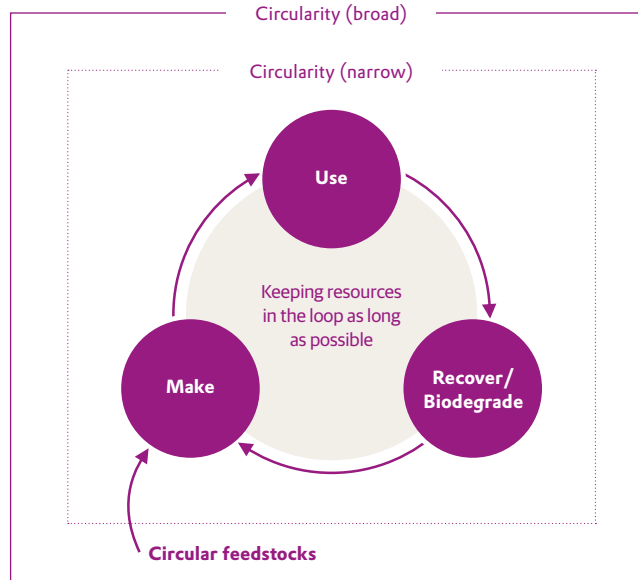
### Strategy and management

Circular economy is a system-oriented approach covering industrial processes and economic activities along the entire value chain. It aims to achieve a climate-neutral, resource-efficient economy, which preserves the value of products, materials, and resources for as long as possible. Circular economy means decoupling economic growth and the use of resources by returning valuable raw materials to the loop at the end of their useful life. Better use of resources and the circular economy are becoming increasingly important for Evonik in view of the limitations of our planet and the diversification of raw materials. As a specialty chemicals company, Evonik is an integral part of various value chains and has in-depth knowledge and expertise in the processes, technologies, opportunities, and risks of upstream and downstream elements. Our activities aim to mitigate the inadequate availability of resources in the supply chain and our production processes and to reduce their dependence on finite fossil-based and other non-circular resources. At the same time, circularity opens up new business opportunities and attractive growth potential for Evonik.

Circular economy involves looking at the entire life cycle of products (C10). The focal areas are the production phase, the usage phase, and the recyclability of the products. In the production phase, recycled, bio-based, or CO<sub>2</sub>-based resources are used as a substitute for fossil-based raw materials. During the usage phase, products are characterized by durability, reparability, and reuse. To close the loop, products have to be recyclable or bio-

### Circular economy

C10



degradable at the end of their life cycle. In this way, less material is sent to landfill or for incineration.

Evonik sees circularity as a fundamental transformation of economic activity. We support all business activities, technologies, and innovations that help to speed up ecologically and economically viable measures to promote circular value chains. Circular

economy is one of Evonik's top 3 material topics (p.11). We drove forward our activities in this area in 2023. For example, we started to draft a circular economy policy, which should be published on our website in 2024. In this way, we are substantiating the status and importance of circularity for Evonik's business activities.

### Ongoing development of the sustainability analysis of our business

Within the WBCSD, Evonik is involved in the ongoing development of portfolio sustainability assessments (PSA (p.20)) to improve the evaluation of product portfolios from the perspective of circularity. In view of this, we integrated our circular economy assessment into the sustainability analysis of our business in the reporting period. The aim is to determine the future opportunities and risks of our portfolio even earlier and more effectively, so that we can derive specific strategic recommendations on how to refine it. To determine the environmental impact of circular products, Evonik mainly uses life cycle assessments in accordance with ISO standards 14040 and 14044. In this context, we also examine which methods could be used for quantitative indicators in the future.

### Global circular economy program

In 2023, we extended our global circular plastics program into a global circular economy program. In this way, we are strengthening the continuous development of our business activities towards a circular economy by integrating all business lines at Evonik. Going beyond the previous focus on the circularity of plastics, we will now look at the circularity of raw materials of all

types and the value chains in all of Evonik's markets. In light of this, our previous targets have been combined in a new target.

Previous targets (global circular plastics program):

- Generate more than €350 million in additional sales with solutions for the circular plastics economy from 2030
- Solutions for around 400,000 metric tons of recyclable plastics by 2025

New target (global circular economy program):

- Generate at least €1 billion in additional sales with circular products and technologies by 2030

The global circular economy program comprises short- to mid-term activities with a clear focus on business development. Here are some examples of our activities:

- the use of circular raw materials,
- the development of solutions for mechanical and chemical recycling technologies,
- the identification of business opportunities and the development of circular business models, and
- intensive examination and structuring of new value chains.

As a specialty chemicals company, Evonik is at the heart of various value chains. Therefore, refining our products and technologies and changing our raw material platforms are the basic preconditions for the circular economy. In addition to our own aspirations, major drivers are the self-commitments of our customers and other companies along the value chain, as they are



See our special magazine section „Implement!“ p.77.

defining increasingly ambitious plans to reduce CO<sub>2</sub> as well as targets for the use of circular materials.

Working with partners along the entire value chain is an important key for Evonik to play a successful role in the transformation to a circular economy. Evonik divides its circular economy activities into upstream, gate-to-gate, and downstream activities.

#### Upstream

The procurement of circular raw materials covers bio-based, recycled (bio-based and non-bio-based), and CO<sub>2</sub>-based materials. Evonik's aim is to increase the use of circular raw materials to reduce the consumption of limited resources, reduce

its own carbon footprint, and, in particular, reduce scope 3 emissions along the value chain. We are therefore examining technical, economic, ecological, and social aspects and developing new business models.

For example, Evonik introduced the ECOHANCE® product program in the reporting period. In this program, skincare products are produced from plant-based residues. For instance, the raw material for ECOHANCE® Care PSC3 is a fatty acid-enriched olive oil that cannot be used in food production. Consequently, this process does not compete with food crops and plays a part in saving primary plant-based resources. Moreover, it supports the development of transparent supply chains and also includes smaller suppliers.

In order to build up a circular system for sustainable recycling of polyurethane, in the reporting period, Evonik teamed up with REMONDIS, one of the world’s leading recycling companies. Within the framework of this cooperation, REMONDIS supplies us with end-of-life mattress foams as a circular raw material.

One ongoing challenge is the limited availability of circular raw materials due to regional fluctuations in supply, the legal framework, and the fact that infrastructure is still at the ramp-up stage.

*Gate-to-gate*

Continuous process optimization and the efficient use of resources have always been very important in our production activities. We use a wide variety of measures to drive our activities towards circularity. These include:

- measuring and reporting on waste from our production plants in keeping with our goal of reducing production waste,
- increasing resource efficiency by continuously optimizing production processes,
- leveraging the benefits of integrated production sites and systems for systematic waste management in alignment with the waste hierarchy, and
- reducing, reusing, and recycling the packaging used for our products.

In our production operations, we prioritize avoiding waste in accordance with the waste hierarchy defined in EU law, mainly

by continuously optimizing operating processes and utilizing the benefits of integrated production sites and systems. As the next step, waste has to be reprocessed or used to generate energy. Safe disposal is merely the third option. Evonik’s goal is to reduce specific production waste relative to production volume by 10 percent between 2021 and 2030. For detailed information on waste, see “The environment” p. 46

Our goals are to close the loop and design more sustainable packaging. In this way, we want to make a contribution to reducing our carbon footprint in the future.

Evonik already uses plastic packaging, including bulk packaging, with a high proportion of recyclate at various sites. The availability of more sustainable packaging options has increased significantly, not least due to more stringent national and European packaging regulations, the introduction of a tax on plastics in various EU countries, and higher demand from customers. Sustainable packaging has not altered the types, appearance, or handling of packaging (filling, palletization, transportation).

We are constantly endeavoring to increase the proportion of recyclable packaging. For categories of packaging where recycling rates are low, increasing the rates is held back by regulatory or technical barriers. We are addressing this in collaboration with representatives of the packaging industry within the German chemical industry association VCI and with our customers. Our recycling rates per category are shown in table T04. 301-1, 301-3

**Recycling rates by packaging categories** 301-3 **T04**

Category in %	Recycling rate per category <sup>a</sup>	Percentage of procurement volume <sup>b</sup>
Bulk containers (>180 l), e.g., IBC <sup>c</sup> , metal drums	18.8	50.3
Small containers (<180 l), e.g., canisters	3.9	5.3
Pallets, e.g., wood and plastic	13.1	20.3
Film, e.g., refuse bags, flat film	8.8	4.6
Paper and cardboard, e.g., corrugated cardboard, paper bags	4.5	11.4
FIBCs <sup>d</sup> , e.g., plastic	–	7.9

<sup>a</sup> Based on weighted average of the units.  
<sup>b</sup> Based on invoice value, rounded.  
<sup>c</sup> IBC = Intermediate bulk container.  
<sup>d</sup> FIBC = Flexible intermediate bulk container.

We are working on various ways of increasing recycling rates for rigid bulk containers depending on the products, processes, and customers. These include the reuse of reconditioned IBCs (intermediate bulk containers; recycling rate: 100 percent) and rebottled IBCs<sup>1</sup> where the steel cage and pallet are reused with a new plastic liner (recycling rate: 70-80 percent). In other areas, we use IBCs with a plastic liner made from about 40 percent post-consumer recycle (PCR), which results in a recycling rate of about 60-65 percent. Since 2022, we have been trialing PCR IBCs on the filling lines for non-hazardous goods at initial sites in Germany. We extended this to further sites and containers in the

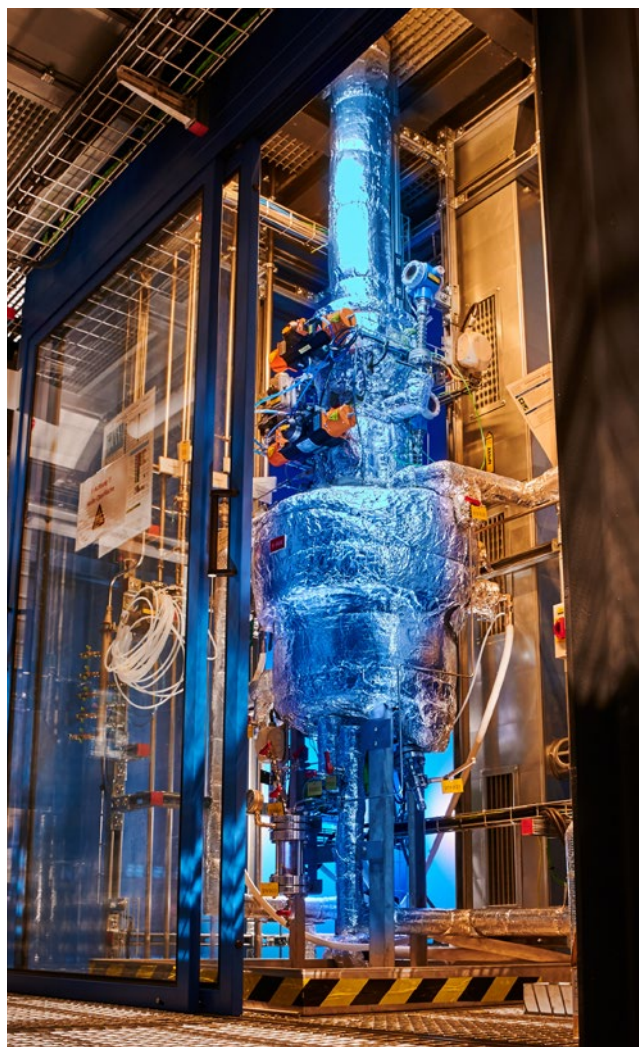
<sup>1</sup> Rebottled IBCs: IBCs where a completely new liner (bottle) is inserted into a used cage.

reporting period. The plan is to roll out usage further locally, nationally, and globally in the future. Since October 2023, we have also been using PCR IBCs and 220-liter plastic drums for hazardous goods. The plan is to roll out usage further locally, nationally, and globally. By increasing the use of reusable systems such as DrumGuard® to secure loads, we are also reducing the use of shrink-wrap film and therefore the amount of plastic waste for our customers.

*Downstream*

Evonik offers solutions that support customers’ and consumers’ circularity aspirations during the use of products and at the end of their life cycle. For example, our additives increase the durability of our customers’ products and therefore make a contribution to saving resources. Furthermore, our additives improve mechanical and chemical recycling processes and recyclates. Evonik provides an extensive range of additives for mechanical recycling. In this way, we help our partners optimize the efficiency and quality of their circular processes and products. Durable products with good usability reduce the use of primary resources and waste. For example, our building protection additives enhance the stability and appearance of concrete structures that are exposed to weathering and environmental influences.

Our surfactants enable printing inks to be washed out of used plastics faster, so they reduce the ink residues in recycled plastics. Moreover, after the washing process, less water remains on the plastic, saving time and energy in the drying process. Our additives also minimize odor and improve the processability and mechanical properties of recyclates. This allows higher yields of secondary materials with better quality recyclates. We are involved in a consortium with BMW and other companies along the value chain that aims to increase the proportion of recyclates that can be used in automotive components to enable circularity in the automotive sector [p.77](#)



Evonik’s pilot plant in Hanau (Germany) for recycling polyurethane mattresses.

In 2023, we continued to partner with Wildplastic, a start-up that supports countries with inadequate waste management systems in the collection of plastic waste from nature by providing fair payment. The recycled plastics are used, for example, in high-quality garbage bags and mailing bags. As well as additives for cleaning and reprocessing, we offer Wildplastic an extensive network and thus support the creation of jobs in the relevant countries. [More](#)

Our products and technologies enable the recycling of used tires at the end of their life cycle for reuse in high-quality applications, thus avoiding incineration. Our partners reduce their ecological footprint by using tire granulates instead of fossil-based bitumen in road surfaces. As well as reducing traffic noise (low-noise asphalt) and cutting fuel consumption by cars, this greatly increases the service life of the road surface, reduces maintenance, and makes the surface recyclable.

Chemical recycling is a solution for waste streams that cannot be recycled eco-efficiently using mechanical or technical processes. That applies, for example, to mixed, heavily contaminated or colored thermoplastics and duroplasts that cannot be melted. To achieve this, Evonik makes additives, adsorbents, catalysts, and process know-how available to its partners. We therefore facilitate chemical recycling of plastics residues that would otherwise be incinerated or disposed of in landfills, for example, by enabling the use of heavily blended or contaminated plastics in the production of pyrolysis oils. In this technology, plastics streams are converted into pyrolysis oil at a high temperature without air. This can be used as a substitute for fossil naphtha in crackers, providing the basic ingredients for the synthesis of polymers. This technology is currently still in the pilot stage. To help meet the ecological and economic requirements on an industrial scale as well, we have increased our product offerings for the production of pyrolysis oils. We supply adsorbents and

catalysts for the separation of contaminants and purification as well as additives that enable the processing of pyrolysis oils at low temperatures. Our SiYPro™ additives help our partners make reprocessing in crackers safer and more robust. Another way of ensuring the circularity of heavily contaminated or mixed plastics streams is the production of synthesis gas. For this too, we provide cleaning technologies such as adsorbents.

Similarly, our alkoxide catalysts and process technologies enable the recycling of PET packaging and colored PET plastics, which are not suitable for mechanical recycling, at the end of their life cycle. We assume that alkoxides will play an important role in chemical recycling of PET plastics in the future. Evonik is expanding its global alkoxides business with a new facility in Singapore. Moreover, other material classes will become significant in the future. For example, Evonik has developed chemical recycling processes to regain the basic components of polyurethanes for use in the production of new polyurethanes. Evonik is providing the know-how in catalysts and process technology, while its partner REMONDIS secures the supply of circular raw materials and is also contributing expertise in recycling logistics at the end of the usage phase.

Since a circular economy extends beyond recycling approaches and includes the production and usage phases of products, Evonik's technologies are also used in design for recycling and design for circularity. For example, our binder for heat-sealing applications allows the production of packaging materials such as

yogurt pots from a single material, so they can be recycled. Other examples are a monomaterial prototype of a car seat produced by 3D printing and monomaterial toothbrushes. In these applications, polyamide 12 is substituted for all previous material blends, facilitating cost-efficient and eco-friendly mechanical recycling. The concept should inspire other product designers to reduce the range of materials used. Moreover, new business models such as leasing could make such concepts viable in more price-sensitive markets. Evonik complements this technical approach by using bio-based products; these are particularly significant for our Nutrition & Care division. One important technology platform that should be mentioned here comprises our biosurfactants, which are a relevant raw material base for various product ranges. Alternative circular solutions are needed for products and ingredients that are difficult or impossible to collect and recycle because of their properties or application. Evonik's answers include, for example, biosurfactants derived entirely from renewable raw materials. For example, our rhamnolipids are used in cosmetic products and domestic cleaning agents. These sugar-based biological products are mild, highly efficient, and fully biodegradable, so they are returned to the biological cycle at the end of their useful life.

### Circular economy: Our engagement in 2023

Evonik is a member of the European Circular Plastics Alliance. This EU initiative aims to return 10 million metric tons of plastic recycle to the market in Europe every year from 2025. Further,

we have extended our involvement with Plastics Europe in Germany and Europe and the European Chemical Industry Council Cefic<sup>1</sup>, both of which support circularity. We are also a member of Circular Economy for Flexible Packaging, an initiative that develops circular solutions for all stages in the flexible packaging value chain. We support the Circular Valley initiative of WupperTalBeWegung e.V., which networks start-ups in the field of circular solutions with industry. It also offers representatives of industry, science, politicians, and the arts a platform for constructive dialogue to encourage the transformation to a circular economy.

Networks and partnerships are the lifeblood of the circular economy. Therefore, frameworks are vital to create a mutual understanding of activities. As a member of the WBCSD, we are continuing to play a part in working groups that are working on standardization and evaluation of circularity, both in the chemical industry and along the value chain.

Evonik is involved in the Carbon2Chem research project<sup>2</sup>, which aims to convert exhaust gases from steelworks into chemical products such as ammonia for nitrogen fertilizers or methanol for use as a production input. We are a partner in the EU project ReProSolar, which is working on the complete recycling of photovoltaic modules<sup>3</sup>. In this context, all components of used modules are completely recycled. This allows pure silicon, silver, and glass to be returned to the manufacturing industry.

<sup>1</sup> Cefic = Conseil Européen des Fédérations de l'Industrie Chimique.

<sup>2</sup> Sub-project L IV: C2+ alcohols, C2+ olefins, synthetic fuel components, funding reference 03EW0008; funded by the Federal Ministry of Education and Research.

<sup>3</sup> EU funding reference 20028.