BACKGROUND PAPER

# PRODUCT PORTFOLIO

LAST UPDATE: MAY 2026

LANXESS
Energizing Chemistry

# MANAGEMENT SUMMARY

We aim to constantly improve the sustainability performance of our product portfolio, to substitute critical products and develop safe alternatives. To achieve this, we take a three-element approach.

The first element focuses on ensuring that our products are safe and sustainable. This is based on the LANXESS Product Sustainability Monitor. Using nine environmental, social and economic criteria, we split our product portfolio into five categories: energizer, performer, transitioner, roadmap and phase-out. We have established our roadmap process in order to continuously reduce the proportion of our products in the roadmap and phase-out categories. We successfully completed the first phase with the 2021/23 roadmap at the end of 2023. Based on new findings, we have started the second phase in 2024, the 2024/26 roadmap, for which we have set the following targets:

- **Roadmap 2024-2026 target:** Develop action plans for newly identified chemical end products that include more than 0.1% substances of very high concern (SVHCs)

- **Implementation of Roadmap 2021-2023:**
  - **Substitution:** Development of sustainable alternatives until 2030
  - **Phase-out:** If it is not possible to develop sustainable alternatives, products will be withdrawn from the market without replacement by the end of 2026

With the second element, we aim to provide climate-neutral and circular products. Next to a low carbon footprint, we intend to use sustainable raw materials and to ensure that our products can be recycled.

- **2030 target:** Reduction of emissions from purchased goods and services (Scope 3.1) by 30% (base year: 2021)

In element three, we consider the benefits and positive environmental impact that our products bring or facilitate during their entire life cycle. Here, we focus on developing solutions that contribute to climate protection or support a circular economy.

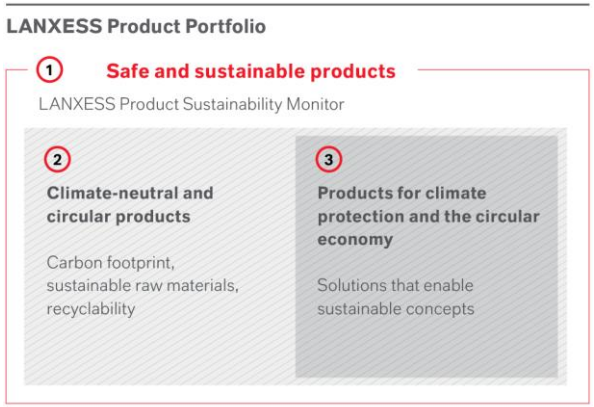
# CONTENT

# PRODUCT PORTFOLIO

In line with societal needs, we aim to constantly improve the sustainability performance of our product portfolio, to identify challenging substances in products and to substitute them or develop safe alternatives. Our products make an active contribution to seven of the 17 United Nations' Sustainable Development Goals (SDGs).

- LANXESS and the SDGs
- LANXESS ESG Equity Story
- LANXESS Corporate Policy

These days, there are a whole host of methods and approaches that help analyze a product portfolio and show different perspectives. However, no universal standard has yet been established. The aim of this publication is to outline and explain the prospects for the LANXESS product portfolio that are most important to us.




To manage our portfolio and develop it in the long term, we take a three-element approach.

The basis for this is our commitment to making safe and sustainable products. As the transformation towards a sustainable product portfolio is an integral part of our corporate strategy, we assess at an early stage of product development whether new products are aligned with our strategic direction**.** With the LANXESS Product Sustainability Monitor we developed an effective management tool to ensure that our products create added value for society and avoid a negative impact on people and the environment. Using this analytical tool, we identify products that are produced in a particularly sustainable manner as well as products where we see potential for improvement in terms of sustainability and continually increase the sustainability performance of our portfolio.

The second element addresses the carbon footprint and circular potential of our products. Here it is important to understand and account for the upstream value chain as well as our own production. Our goal is to continuously reduce the negative impact on the climate of the manufacturing of our raw materials, our logistics, but also of our own production. We aim to use sustainable raw materials and to ensure that our products can be recycled.

In the third element, we look at the benefit of our products in their application. A sustainable world needs new concepts, such as in the areas of climate protection or circular economy.

# 1. SAFE AND SUSTAINABLE PRODUCTS

**LANXESS Product Sustainability Monitor**

The LANXESS Product Sustainability Monitor is our strategic management tool that we use to align our portfolio with sustainability. It allows us to analyze risks and potential for improvement and systematically improve sustainability performance, taking account of environmental, social and economic effects. The system, which is optimized on an ongoing basis, analyzes the benefits and impact of our products using criteria that are relevant to LANXESS and to society. Using the LANXESS Product Sustainability Monitor, we divide our portfolio into five categories:

- **Energizer:** Products in this category offer outstanding sustainability performance. They fulfill our highest sustainability requirements in most criteria and have no intrinsic properties that give cause for concern. Energizers are manufactured with a very low to low environmental impact. These products contribute to at least one SDG and are experiencing increasing demand.
- **Performer:** Products that are sustainable according to the current state of the art. They fulfill the present sustainability requirements or exceed them in many categories. Performers are manufactured with a low to medium environmental impact and have a benefit to society.
- **Transitioner:** Products that do not yet fulfill all LANXESS sustainability requirements. We monitor these products and actively steer them by way of improvement measures, for example to reduce their environmental impact and make these products more sustainable.
- **Roadmap 2024-2026:** This category covers products with serious sustainability concerns, namely chemical end products with more than 0.1 % by mass of substances with the properties of substances of very high concern (SVHC). We manage these products in our roadmap process, in which we examine in particular whether challenging substances in the respective chemical end products could be replaced with safe and sustainable alternatives.
- **Phase-out:** Action plans have been developed for these products for the years 2021 to 2023 with the aim of replacing them with sustainable alternatives by 2030. If the use of sustainable alternatives is not possible, we will withdraw the relevant products from the market without replacement by the end of 2026.

**LANXESS 2025 product portfolio**

In 2025, we already generated 84 % of our total sales with products that fulfill our high/highest sustainability requirements (energizer and performer products). Only 13 % of our sales were attributable to products that did not (yet) completely fulfill our sustainability requirements (transitioner and roadmap products). We continually improve our product portfolio and invest in product innovation.

**LANXESS Product Portfolio (2025)**
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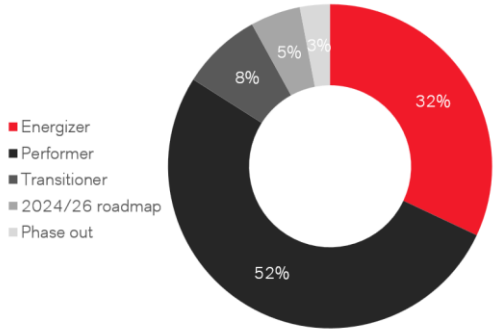



We support a holistic “sustainable-by-design” approach, which covers aspects such as safety, the circular economy, energy efficiency and functionality, and wherever possible opt for safe and sustainable ingredients for our innovative solutions.

**Examples: Energizer**

**Energizer – Baypure® CX100:** Complexing agents are almost everywhere in our daily lives. At home, in industry and in the trades, they are required wherever water is used to ensure that water is used efficiently. Baypure® CX100 from the Polymer Additives business unit (BU) not only improves the efficiency of washing detergents and cleaning products, it is also entirely harmless in terms of toxicology and is easily biodegradable. In addition, no waste is produced during the entire product lifecycle that then needs to be disposed of.

Baypure® CX100 solid G

**Energizer – BAYOXIDE® E 33:** Arsenic is a highly toxic pollutant that can enter groundwater, e.g. through the decomposition of minerals. LANXESS adsorbers such as Bayoxide E 33 are able to selectively purify contaminated drinking water and reduce the arsenic concentration to well below the WHO limit of 10 ppb.

BAYOXIDE

***Management of challenging substances – Roadmap***

We are committed to constantly improving the sustainability performance of our product portfolio, substituting challenging substances and developing safe alternatives. To support this ambition we are committed to dedicate innovation resources and budget to the development of sustainable substitutes. To guide our efforts, we have established our structured roadmap process with the following targets:

**Roadmap 2024-2026 target:** Develop action plans for newly identified chemical end products that include more than 0.1 % substances of very high concern (SVHCs).

**Implementation of Roadmap 2021-2023:**

- **Substitution**: Development of sustainable alternatives until 2030
- **Phase-out:** If it is not possible to develop sustainable alternatives, products will be withdrawn from the market without replacement by the end of 2026

As part of our roadmap process, we are examining whether challenging substances in the respective chemical end products could be replaced with safe and sustainable alternatives. We do not switch to other substances that experts believe could have comparable hazardous properties but that are not currently subject to restrictions. If it is not possible to use sustainable alternatives, we will remove the products from the portfolio. If the socio-economic repercussions of discontinuing a product are too severe, we will take science-based risk mitigation measures to ensure safe use of the product worldwide. In cases of doubt, we will conduct socio-economic analyses and carefully weigh up the benefits and risks to human health and the environment. Specific action plans were developed for all roadmap products for 2021-23 by the end of 2023. Based on the reference year 2021, we will stop marketing 21% of sales of Roadmap products by 2026 and offer alternatives for a further 69% by 2030. For the remaining 10% of sales of roadmap products that we are currently unable to replace, our analysis has shown that they are only used under controlled and safe conditions by professional users. We are continuously improving our product portfolio and investing in product innovations.

In 2023, we analyzed the transitioner category in our product portfolio in detail, taking into account new scientific findings and regulatory developments. Challenging properties have been confirmed or are forecast for 46% of transitioner products. We developed a new roadmap process for these products and will develop additional action plans over the next three years. In future, these products will be listed in the Roadmap 2024/26 category. Concerns regarding critical properties have not been confirmed for 22% of the products. For a further 32%, the outcome is still uncertain. We will continue to monitor these products closely as part of the Transitioner category.

All products containing restricted substances in the Annex XVII of REACH Regulation or containing substances on the Candidate List of substances of very high concern (SVHC) for Authorization above 0.1% by weight are included in the roadmap process.

**Examples: Product substitution**

**Bis(2,6-diisopropylphenyl)carbodiimid:** Bis(2,6-diisopropylphenyl)carbodiimide, the active ingredient in our product Stabaxol I, which is used as a hydrolysis stabilizer in plastics, has been identified as a substance of very high concern due to its reprotoxic properties. We developed sustainable alternatives such as Stabaxol L, based on a differently substituted carbodiimide with a much better hazard profile.

**Imidazolidin-2-thion** is an active ingredient in our RHENOGRAN / RHENOSLAB ETU products, which are used as vulcanization accelerators for rubber. Imidazolidine-2-thione has been identified as a substance of very high concern due to its reprotoxic properties. We developed substitutes Rhenocure CRV/LG, Rhenogran MTT-80 (based on 3-methylthiazolidine-2-thione) and Rhenocure DR/S based on sodium aluminum silicate which have a significantly better hazard profile.

## LANXESS Product Sustainability Monitor method

We have been conducting our product portfolio analysis since 2016 and further developing this ever since. We look at nine criteria, which account for production factors, substance properties, economic factors and external perspectives. Our analysis goes beyond legal requirements and evaluates all LANXESS products.

Under the "climate change," "water use and water risk" and "waste efficiency" criteria, we assess the environmental and social impact of manufacturing our products. The methods and limits are based on the recommendations of the German Environment Agency set out in the "Guide on sustainable chemicals."

- **Climate change:** Manufacturing products with low greenhouse gas emissions helps reduce climate change. We take account of direct emissions from corporate activities (Scope 1) and indirect emissions from energy purchased for our own use (Scope 2) that we can influence directly. For the "climate change" criterion, we calculate the specific Scope 1 and Scope 2 emissions per kilogram of product manufactured.
- **Water use and water risk:** The regional context plays an important role in sustainable water management. Accordingly, the local water stress situation is one of the key parameters. We assess this using a matrix structure, where we compare the quantity of water that we remove to manufacture our products to the water stress score (average current and future water stress in a region) of the production site. The assessment of water risks is based on the "Aqueduct Water Risk Atlas" from the "World Resources Institute".
- **Waste efficiency:** To conserve resources, we aim to reduce waste at our production plants. For the "waste efficiency" criterion, we consider the specific volume of waste per kilogram of product.

Further information can be found at:

- Background Paper Climate
- Background Paper Water
- Background Paper Value Chain Responsibility

**Criteria of the LANXESS Product Sustainability Monitor**

The “environmental risk” and “human health risk” criteria consider potential risks that could result from chemical products. They arise in connection with the properties of the substances included in a chemical product, combined with knowledge about its use. We use a risk-based screening approach that considers the hazardous nature and exposure potential of a chemical product. Hazardous nature is defined using the criteria in the UN’s Globally Harmonized System of Classification and Labeling of Chemicals (GHS). Exposure potential results from the use of the products. In our screening process, we differentiate between chemical intermediates and chemical end products. Intermediates are chemically converted into products with other properties in enclosed industrial facilities. For example, a toxic chemical intermediate can be turned into a non-hazardous end product without the consumers coming into contact with the intermediate. Consumers generally do not come into contact with our chemical end products either, as they are further processed by our industrial customers.

- **Environmental risks:** Potential risks for the environment resulting from the hazard profile of the chemical end products. The assessment is a matrix assessment based on the hazard classes of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) in the hazard category environment hazards as well as the use of the product.
- **Human health risks:** Potential risks to human health resulting from the hazard profile of the chemical end products. The assessment is based on the hazard classes in the hazard category human hazards as well as the use of the product.

With our LANXESS Product Sustainability Monitor, we also review the benefits/added value generated by our products.

- **for Sustainable Development Goals/Agenda 2030 (product benefit):** In view of Agenda 2030, it is important that products have a positive social and environmental impact.
- **Demand trends:** Rising demand is an indicator of the high economic value of the products.
- **Profitability:** The profitability of our products is crucial to the economic success of our company.

We also analyze “legislative and reputational risks” in connection with our products.

- **Legislative and reputational risks:** The legislative perspective is based on compliance with local and global laws. We measure the general public’s perception through publications by non-government organizations. These help us identify risks that affect our product portfolio and also reflect our own perceptions compared to those of external third parties. In our assessment, we use the same standards for the entire portfolio, regardless of where the products are produced and sold.

Based on this list of criteria, our Product Stewardship Group evaluates the entire product portfolio once a year. The findings are then reviewed by an internal committee of experts.

The analysis shows us which of our products help overcome central and global sustainability challenges – and what topics we need to work on to make our product portfolio sustainable.

**Info box: Principles of the LANXESS Product Sustainability Monitor**

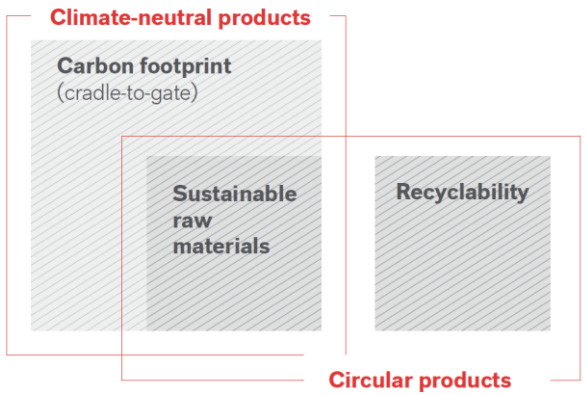
We continue to refine the method of the LANXESS Product Sustainability Monitor on an ongoing basis, taking account of global regulations, environmental agreements, agreements under international law, information from environmental organizations as well as recognized international standards and methods:

- EU REACH regulation (Registration, Evaluation, Authorization and Restriction of Chemicals)
- Montreal Protocol on substances that deplete the ozone layer
- Stockholm Convention on Persistent Organic Pollutants (POP)
- Rotterdam Convention on the Prior Informed Consent (PIC) procedure for certain hazardous chemicals and pesticides in international trade
- Substitute It Now (SIN) lists by ChemSec, International Chemical Secretariat database for chemicals
- International Agency for Research on Cancer (IARC) monographs
- SAICM lists (Strategic Approach to International Chemicals Management) by the UN on endocrine disruptors
- WBCSD Portfolio Sustainability Assessment (PSA)
- 12 Principles of Green Chemistry
- Recommendations by the German Environment Agency (“Umweltbundesamt”/UBA) in the guide on sustainable chemicals
- “Aqueduct Water Risk Atlas” from the WRI
- Prioritization Screening Method by the American Chemistry Council
- UN’s Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

## 2. CLIMATE-NEUTRAL AND CIRCULAR PRODUCTS

LANXESS wants to help transform the entire value creation system into a resource-efficient and climate-neutral society. To achieve this, it is essential to manufacture products with a lower carbon footprint – all the way to carbon-neutral products. To ensure that the product carbon footprint (PCF) from "cradle to gate" (from when the raw material is extracted to when it leaves the factory gate) is as low as possible, it is important to use raw materials with a reduced or neutral carbon footprint, as raw materials account for the largest portion of our products' PCF. Sustainable (or circular) raw materials can essentially come from two cycles: the biological cycle of the nature or the technical cycle, i.e. in form of recycling. Ensuring closed-loop technical cycles, in particular, will be increasingly vital in the future. Accordingly, one of our strategic focus areas is the recyclability of our products. To produce carbon neutral and circular products, we are working on three, partially overlapping action areas.

**Three Elements for Climate-Neutral and Circular Products**




**Info box Scopeblue brand**

The Scopeblue brand identifies products that facilitate environmentally friendly solutions and contribute to a circular economy. They provide tangible sustainability benefits for our customers while also meeting regulatory authorities' requirements. Only products that meet the "Energizer" or "Performer" category requirements in the LANXESS Product Sustainability Monitor are eligible for the Scopeblue label. In addition, they must also meet at least one of the following two criteria:

1. The products comprise at least 50 % sustainable raw materials and the carbon footprint is a at least 10% reduced
2. The carbon footprint of the products is at least 50 % lower than for conventional products

### Reducing the carbon footprint

We can directly influence Scope 1 and Scope 2 emissions generated by our production and by the energy we source. With our strategy of being carbon neutral by 2040, we have set ourselves ambitious targets to reduce carbon dioxide ($CO_2$) (see background paper climate). One central lever we are employing to reduce our process emissions is found at our facilities to break down nitrous oxide ($N_2O$), known as laughing gas, in Krefeld-Uerdingen. As nitrous oxide is about 300-times more harmful to the environment than $CO_2$, the PCF of products that we make using this technology is far lower than that of our competitors who do not use nitrous oxide reduction facilities in their production process. Essential to reducing the PCF are the Scope 3 emissions of purchased goods, i.e. our raw materials. In chemical production, they often account for more than 50 % of the PCF.

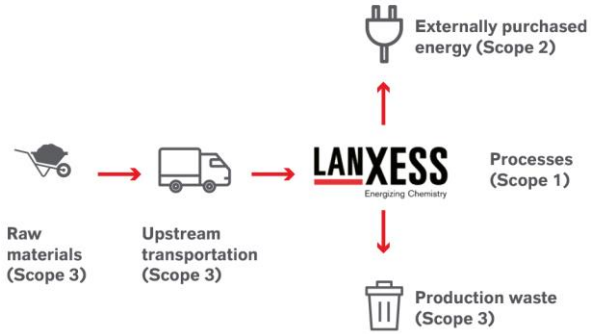
We are therefore placing a strategic focus on the purchase of sustainable raw materials with a reduced carbon footprint (see "Sustainable raw materials"). For our total Scope 3 emissions, we are aiming to make our upstream and downstream supply chains carbon neutral by 2050.

**Examples: Certified products with reduced PCF**

With the help of our $N_2O$ reduction facility in Krefeld-Uerdingen, the Advanced Industrial Intermediates BU makes adipic acid and 1.6-Hexanediol with a PCF that is 90 % lower than is typical in the market. To calculate the PCF, we prepared a full mass and energy footprint of operations and assigned emissions to all incoming raw materials, energy, operating equipment and outgoing waste accordingly. Emissions were broken down for both products. Our calculation and the operating data are audited externally.

Advanced Industrial Intermediates

**Cradle-to-Gate Carbon Footprint**



We developed a digital “Product Carbon Footprint Engine” that automatically calculates the PCF of our products. Here, we take account of several established standards and ensure that our methods meet external requirements.

**Info box: Digital PCF (Product Carbon Footprint) Engine**

We follow the "cradle-to-gate" approach when calculating the PCF. Our systematic approach is certified by TÜV Rheinland in accordance with the ISO 14067 standard and follows the Together for Sustainability (TfS) guidelines.

## Sustainable raw materials

The choice of raw materials is crucial to the carbon footprint of most of our products (Scope 3.1 emissions). Therefore, we have set a separate target to reduce our Scope 3.1 emissions.

**2030 target:** Reduction of emissions from purchased goods and services (Scope 3.1) by 30% (base year: 2021)

We actively pursue this goal by improving our raw material base. We use both organic and inorganic raw materials. Organic raw materials are extracted primarily from fossil fuels (crude oil, natural gas and coal). In the future, these are to be obtained from the biological cycle as bio-based raw materials or from the technical cycle as recycled raw materials. A third option is Power-to-X technology, where electricity is used to convert less reactive molecules such as carbon dioxide ($CO_2$) or water into basic chemicals.

We aim to increase the share of sustainable raw materials in our production and are looking closely into all alternative ways of extracting raw materials. The market for sustainable raw materials is developing slowly but steadily. To make progress, we are already working with multiple major partners and testing their research products. A realistic scenario is that we will increasingly bring individual products based on sustainable raw materials to market before this is possible for the entire product range. However, the use of bio-based organic raw materials also entails challenges and potential conflicts, such as the competition for food production or the influence on biodiversity. We take these factors into account in strategic decisions about raw materials.

Inorganic raw materials are primarily mined as ore (e. g. phosphorus), sourced from the air or the sea (e. g. nitrogen and sodium chloride) or are a by-product of extracting fossil fuels (e. g. sulfur).

From a sustainability perspective, the most important aspect to consider when looking at these raw materials is their availability, i.e. whether they are unlimited (can be naturally recovered more quickly than they are used) or limited. For inorganic raw materials, too, our intention is to make recycling as loss-free as possible or ensure that limited substances can be substituted. Even if inorganic raw materials are unlimited, this does not necessarily mean they are sustainable, as a high energy input (electricity) is needed to extract or recycle them. To reduce their carbon footprint, renewable energy needs to be increasingly used for their extraction. We actively address this challenge in strategic partnerships with our suppliers.

Switching from fossil raw materials to sustainable sources not only reduces our greenhouse gas emissions, it also makes our value chains more resilient.

**Info box: More sustainable production – LANXESS und bp cooperation**

We have a strategic partnership with the energy company bp to help us increase the use of sustainable raw materials in our production. Since the fourth quarter of 2021, bp has supplied us with bio-based and bio-recyclable cyclohexane, based on raw materials such as rapeseed oil or other biomass, which our Advanced Industrial Intermediates BU uses to make bio-based products. The sustainable origin of the raw materials is certified according to the rules of the International Sustainability and Carbon Certification (ISCC) Plus.

Further information on the cooperation with bp

**Examples: LANXESS products from sustainable raw materials**

**Trimethylolpropane (TMP) Scopeblue:** We use 100 % bio-based n-butyl aldehyde to produce our TMP Scopeblue. 54 % of the Advanced Industrial Intermediates BU's latest product is made of sustainable raw materials. The TMP Scopeblue and the entire value chain are ISCC Plus certified. TMP is used, for example, for varnishes, foam, adhesives and lubricants in transport, construction and for consumer goods.

**Lewatit Scopeblue:** We increasingly use bio-based and circular raw materials to produce ion exchange resins. Our Liquid Purification Technologies (LPT) business unit offers first ion exchange resins produced using bio-based raw materials under the mass balance method. These so called weakly acidic cation exchangers are used, for example, in filter cartridges to decarbonize drinking water. The new Lewatit Scopeblue types are made from 90 % sustainable raw materials, reducing their carbon footprint by at least 50 % compared to conventional products. The acrylonitrile used in production is currently bio-circular – it is made from biogenic waste.

**Additin Scopblue:** Sulfur-carrier additives of the Additin brand are light in color, low in odor and are mainly used in metalworking lubricants. They reduce wear on metal surfaces and prevent cold welding even under extreme conditions such as high pressure. Because of their beneficial ecotoxicological profile, light-color sulfur carriers are increasingly replacing other chemical substances such as chlorinated paraffins, which have been classified as "Substances of Very High Concern" (SVHCs) by the European Chemicals Agency (ECHA) due to their environmental persistence and high bioaccumulation potential.

## Recyclability

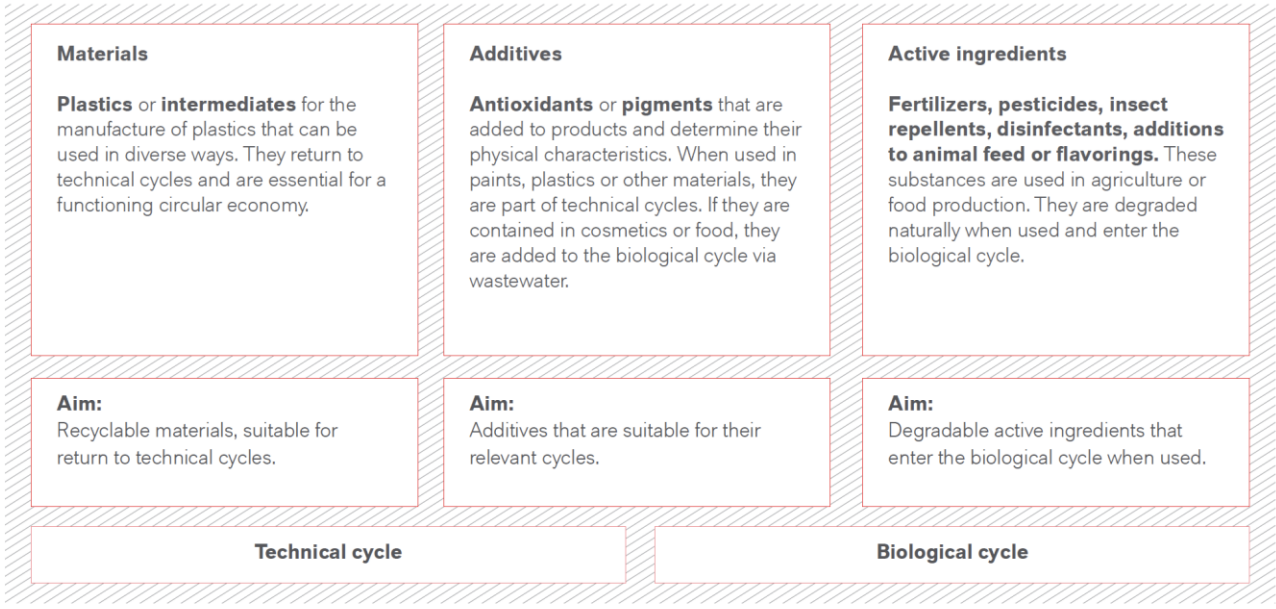
LANXESS products are sold almost exclusively to industrial customers. Only they or customers even further downstream use them to produce end products for a wide range of markets. Also our chemical end products, which remain unchanged in the further value chain, are only processed into end products by our customers. With regard to closing loops, this means that there are sometimes very long periods between production and the end of our products' life cycles.

As a first step, we focus on ensuring the "recyclability" of our products so that they are suitable for environmentally friendly recycling.

In order to understand which "recyclability" requirements to impose on our products, we analyze the function of our molecules in their final use and in which cycles (biological or technical) they circulate.

Essentially, **materials** such as plastics (and thus also intermediates for their production) can be used completely in a closed-loop system. Depending on the properties of the substances, different recycling methods can be employed that go far beyond mechanical recycling. For example, chemical recycling allows contaminated, unsorted or very old plastics to be turned into new raw materials for the chemicals industry. This process can help the circular economy achieve a technological breakthrough.

**Allocation of LANXESS Products to Cycles According to Their Use (Examples)**



We expect recycling value chains to combine mechanical and chemical recycling methods in the future.

**Additives** are added to products in small quantities to optimize their physical properties. As they account only for a small percentage by mass, it is not usually worth recycling the additive. It is thus particularly important that they, depending on the product in which they are used, are suitable for recycling in a technical or biological cycle.

**Info box: Cooperation with the Karlsruhe Institute of Technology (KIT)**

One example of additives in the LANXESS portfolio are bromine and phosphorus-based flame retardants from the Polymer Additives BU, which are added to plastics to ensure safe use in a wide range of applications. To prevent chemicals containing bromine or phosphorus disrupting the recycling process, we partnered with the Karlsruhe Institute of Technology (KIT). The project conducts experiments on the chemical recycling of the plastics to which flame retardants were added. It looks not only at the feasibility of recovering organic raw materials, but also at recovering bromine and phosphorus. The aim is to optimize the process and transfer it to an industrial scale. A KIT study showed that chemical recycling methods score better than other methods when it comes to recycling costs and carbon efficiency.

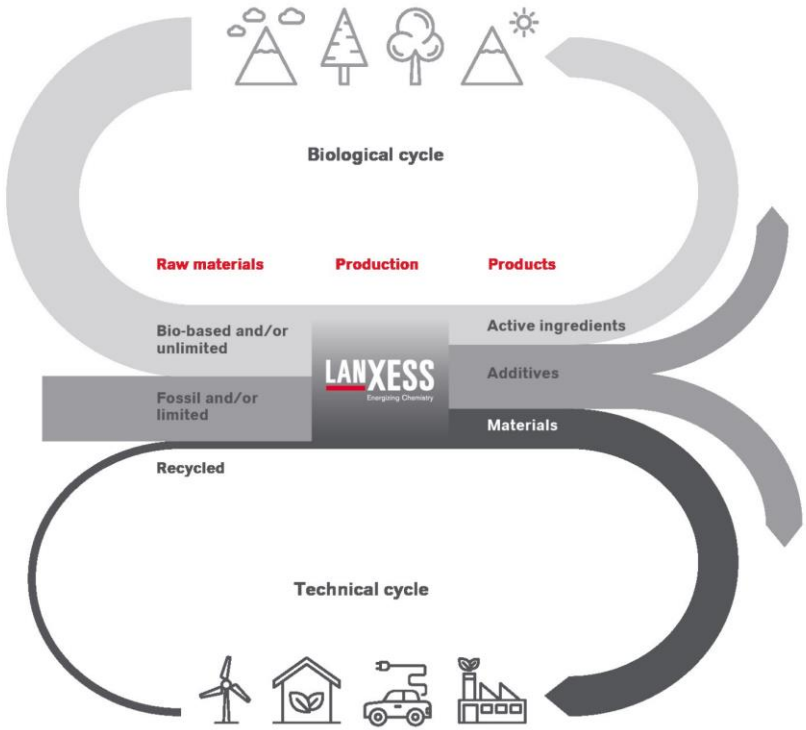
Further information on the cooperation can be found in the interview

KIT study on different recycling methods

Examples of **active ingredients** include disinfectants and agricultural chemicals. Due to how they are used, these cannot be recovered for the technical cycle and instead go straight to the biological cycle and thus the natural regeneration processes. Instead of technical recycling, biodegradability must therefore be ensured.

We use roughly equal amounts of organic and inorganic raw materials in our production. A portion of our raw materials already comes from recycled and organic/inorganic bio-based sources.

**Circularity of the LANXESS Product Portfolio**



# 3. PRODUCTS FOR CLIMATE PROTECTION AND THE CIRCULAR ECONOMY

A full picture of our product portfolio is obtained only when assessing the benefit and the positive environmental impact that our products have when used. Here, we prioritize solutions that contribute to climate protection or enable a circular economy.

**Climate change solutions**

Products that support climate protection are suitable for reducing greenhouse gas emissions and thus stopping or slowing climate change (climate mitigation). A second important group are products that support adaptations to climate change. These help cope with the negative consequence or changes in the climate that are expected in the future (climate adaptation).

***Climate mitigation***

The biggest drivers of climate change are the generation of electricity and heat from fossil fuels. The change to renewable energy requires a large number of new solutions, especially for wind power, photovoltaics and the necessary storage of energy in the form of batteries or hydrogen.

**Examples: Electricity and heat generation solutions**

**Lubricants for wind turbines:** Our lubricants from the Lubricant Additives BU's Hatcol® portfolio encompass a broad range of diesters and polyesters, which are characterized by their high degree of purity and thermal resistance. These are used, for example, in wind turbines, and increase their longevity.

Lubricant Additives Business

**Heat transfer medium for photovoltaic cells:** Our organic heat transfer fluid Diphyl® from the Advanced Industrial Intermediates BU can be used at temperatures of up to 400 °C and results in more efficient solar energy generation.

Advanced Industrial Intermediates

The transport sector and especially road traffic are other significant causes of climate change. In recent years, electric mobility has also become established as an important path to a sustainable future in road transport.

**Examples: Road traffic solutions**

**Battery immersion coolant for safe, rapid charging:** Charging batteries quickly generates more heat, which is problematic for the heat-sensitive lithium-ion battery cells. The more powerful the batteries, the greater the problem. Immersion cooling fluids allow rapid charging of electric vehicle batteries by effectively dissipating surplus heat from the battery cells during charging. Our Lubricant Additives BU offers a range of harmless, non-conductive and flame-retardant coolants, ensuring the batteries are safe to use for rapid charging.

Immersion coolants

Industry and the building sector are in third place when it comes to the emission of greenhouse gases. Electrification and insulation play a key role here. We address all these topics in our product portfolio.

**Examples: Solutions for the building sector and industry**

**The color orange shows live components:** The Rhein Chemie BU produces Macrolex Orange HT, a heat-resistant dye for permanently coloring high-voltage components.

Macrolex Orange HT

**Flame retardant for insulation:** The Polymer Additives BU makes phosphorus- and bromine-based flame retardants. They are used for heat insulation in buildings, as well as in the electrics and electronics industry and in the transport sector, for example in polymer cases.

Polymer Additives

***Climate adaptation***

The effects of climate change are already plain to see in many regions of the world. Changing water cycles and thus new patterns of precipitation and evaporation are one consequence of climate change. While some regions are facing higher rainfall and flooding, others are suffering increased water shortages. In this respect, the circulation of process water and the purification of drinking water are becoming important elements of local water strategies. The Liquid Purification Technologies BU provides support here with years of experience, a broad product range and innovative solutions.

Another consequence of climate change is the increasing threat of infectious diseases. These are transmitted primarily by insects, rodents and birds, whose population size and risk of transmission is significantly affected by climate factors. Global warming is enabling certain pathogens to advance and survive not only in tropical but also in temperate zones. Other factors such as globalized passenger, livestock and goods transport help these diseases to spread faster and farther. For years, we have continuously enhanced our range of disinfectants. In particular, our Rely+On Virkon disinfectant helped fight the COVID-19 virus.

**Examples: Products that help adapt to climate change**

**Ion exchangers for water treatment:** Using our LewaPlus® software from the Liquid Purification Technologies BU, our customers can have optimal control over their water treatment systems, minimizing the use of chemicals and water and thus reducing the carbon footprint of water treatment.

More information on our LewaPlus® software

**Disinfection:** The Material Protection Products BU develops active ingredients, preservatives and disinfectants, the materials that protect against spoilage due to microorganisms such as viruses, bacteria, yeasts, mold and algae. These substances are used, amongst others, in agriculture, the construction, electronics and timber industry, as well as in the beverages and water industries.

Material Protection Products

**Solutions for the circular economy**

A functioning circular economy needs more than just alternative raw materials and environmentally friendly recycling at the end of the lifecycle. It also needs products that help materials to be used for longer and to be reused.

Additives and material protection offer solutions for both problems. Particularly in the case of plastics, the product lifecycle can be significantly extended with the use of additives. For example, stabilizers provide protection against the elements and light and mean that plastic products can be used for many years without compromising on quality or safety. When renewable materials such as wood are used, material protection solutions also extend their useful life many times over.

**Examples: Additives extend product lifespan**

Baynox® from the Advanced Industrial Intermediates BU stabilizes biodiesel and stops it aging.

Baynox®

The Rhein Chemie BU's portfolio contains a large number of additives:

- Perkalink® preserves the elasticity of rubber so that tires can be used for longer.
- The Vulkanox® and Rhenogran® product lines stop materials reacting with oxygen.

Rubber Additives

If it is no longer possible to continue using products and they reach the end of their lifecycle, they must be recycled in an environmentally friendly manner. Here, too, the right additives help to complete the cycle. For example, this can be done using additives required in the recycling process to offset quality losses in the material during the use phase and allow new high-quality products to be manufactured.

**Examples: Products that facilitate recycling**

Black Bayferrox® 303T pigment from the Inorganic Pigments BU makes it easier to recycle plastic packaging as it enables separation at automated sorting facilities.

Bayferrox® 303T

The Aktiplast® 79 additive from the Rhein Chemie business unit is used to recycle waste from natural or synthetic rubber. It allows rubber, which becomes brittle over time, to regenerate and restores its elastic properties.

Rubber Additives – Recycling

# GLOSSARY

**Active ingredient:** A substance, either endogenous or exogenous, that interferes with biological processes or acts as a medicine.

**Additive:** A substance added to plastics, washing detergents etc. to diminish unwanted properties or create desired properties.

**Biological cycle:**[1] Biodegradable products that cannot be reused, such as fertilizers, can be returned to the biological cycle. Through composting or anaerobic fermentation of organic materials, valuable nutrients such as nitrogen, phosphorous and potassium can be recovered that help regenerate the soil so that we can grow more food or renewable materials such as cotton and wood.

**Business Unit (BU):** The business units are responsible for our operating business and are split into the three segments Advanced Intermediates, Consumer Protection and Specialty Additives.

**Carbon footprint (product carbon footprint / PCF):** The amount of greenhouse gases generated directly or indirectly due to product manufacturing (cradle-to-gate).

**Chemical end product:** A product whose chemical properties are not changed further. Further mechanical processing is possible, which may change the physical properties.

**Chemical intermediate:** A chemical product that is further converted in a chemical process so that its chemical and physical properties change.

**Chemical product:** Comprises an individual chemical substance or a mix of several chemical substances.

**Chemical recycling:** Chemical recycling could be the technology that helps the circular economy achieve a breakthrough. It is suitable for waste that is too complex or too contaminated for mechanical recycling, meaning that mechanical and chemical recycling complement each other. The aim of chemical recycling is to extract monomers or petrochemical raw materials and regenerate unsorted waste for the chemical industry. Using a variety of methods, the material is broken down into its chemical building blocks:

- **Depolymerization:** Converting macromolecules into their constituent parts (monomers).
- **Pyrolysis:** Using slight thermal decomposition, polymers are broken down into monomers or other chemical materials. The process is suitable for unsorted and slightly contaminated waste. The material obtained can be reused as a raw material for chemical value chains.
- **Gasification:** Strong thermal decomposition is suitable for unsorted and even highly contaminated waste. Organic materials are turned into synthesis gas (mixture of hydrogen and carbon monoxide) or other light raw materials that can be used as a raw material to produce many chemical products.

**Chemical substance:** An element or compound with certain chemical and physical properties.

**Cradle-to-gate:** Part of the product lifecycle from resource extraction (cradle) to when it leaves the factory (gate).

**Endocrine Disruption Exchange (TEDX):** A non-profit organization that provides a database of chemicals that TEDX believes have the potential to disrupt the hormonal system.

**Globally Harmonized System of Classification and Labeling of Chemicals (GHS):** is intended to ensure the safe use, transport and disposal of chemicals in a world shaped by extensive global trade. The system classifies chemicals by types of hazard and proposes harmonized hazard communication elements, including labels and safety data sheets. The GHS is mandatory in the EU through the Classification, Labeling and Packaging (CLP) Regulation.

**Greenhouse gases (GHGs):** GHGs are gases that contribute to the greenhouse effect through the absorption and reflection of atmospheric and solar energy. GHGs include carbon dioxide ($CO_2$), nitrous oxide ($N_2O$), methane ($CH_4$), fluorinated hydrocarbons (HFC), perfluorocarbons (PFC) and sulfur hexafluoride ($SF_6$).

**Inorganic substances:** Carbon-free compounds such as metals, salts and minerals.

**International Agency for Research on Cancer (IARC) monographs:** The IARC monographs identify environmental factors that are carcinogenic for humans. These include chemicals, complex mixtures, work-related exposure, physical active ingredients, biological active ingredients and lifestyles.

**Material:** Substance or raw material from which something is made or manufactured.

**Mechanical recycling:** When processing plastic waste in this way, the chemical structures of the material are not broken down. Mechanical recycling has been used for a long time and includes collecting, separating, grinding, melting, sorting, washing and filtering materials. It is not suitable in all cases, as the plastic breaks down over its lifetime. In addition, only clean plastics that have been separated according to type are suitable for mechanical recycling.

**Montreal Protocol:** A multilateral environmental agreement that regulates the production and use of almost 100 man-made chemicals that are considered ozone-depleting substances.

**Organic substances:** Carbon-containing compounds in the form of chains or rings, to which hydrogen atoms and other elements bind. Examples include crude oil, natural gas and coal, as well as biological substances such as amino acids, proteins and carbohydrates.

**REACH (Registration, Evaluation, Authorization and Restriction of Chemicals):** The REACH regulation, enacted by the EU states, requires that chemicals must be registered, evaluated and authorized before they are marketed, and mandates manufacturers or importers to determine any hazardous properties of materials and assess their impact on health and on the environment.

**Rotterdam Convention:** Treaty on chemical safety. It sets out regulations on international trade in certain hazardous chemicals and requires exporting countries to provide importing countries with information on the toxicological and ecotoxicological properties and a safety evaluation of these substances. The objectives of the convention are shared responsibility and cooperation between the contracting states to protect human health and the environment from substance risks.

**Scope 1 emissions:** These are all direct GHG emissions from sources owned or controlled by the company. These are above all process emissions and emissions from self-generated energy. Our Scope 1 emissions include carbon dioxide ($CO_2$), nitrous oxide ($N_2O$), methane ($CH_4$) and fluorinated hydrocarbons (HFC) emissions, which are calculated in the form of $CO_2$ equivalents ($CO_2e$). Perfluorocarbon (PFC) and sulfur hexafluoride ($SF_6$) emissions are also counted as GHG emissions, but are not relevant to LANXESS.

**Scope 2 emissions:** These are all indirect GHG emissions resulting from the generation of purchased electricity and steam as well as from purchased heating and cooling energy that is used by a company. Our Scope 2 emissions mainly comprise $CO_2$ emissions. Since 2016, in accordance with the guidelines set out in the Greenhouse Gas Protocol, companies have been required to be more explicit in how they indicate their Scope 2 emissions. A distinction is made between two different recording methods:

- **Market-based:** Market-based figures relate to the emission factors of the energy supplier or an individual energy product.
- **Location-based:** Location-based figures relate to the average emission factors of the region in which the energy is consumed. The nationwide average is usually used as a basis here.

**Scope 3 emissions:** These are all indirect GHG emissions from activities along the value chain, originating from sources that are not owned or controlled by the company. These generally account for the majority of the carbon footprint and include emissions generated during purchasing, transportation, waste disposal and business trips.

**Stockholm Convention:** Agreement on internationally binding prohibition and restriction of certain persistent organic pollutants (POP). POPs are organic chemicals characterized by their longevity (persistence), that accumulate in the food chain, have harmful effects on people or the environment and can be transported over long distances.

**Strategic Approach to International Chemicals Management (SAICM) lists:** SAICM is a non-binding framework passed in 2006 that aims to promote sustainable chemicals management. The negative impact of chemicals usage on people and the environment should be reduced to a minimum.

**Substance of very high concern (SVHC):** Substances that meet at least one of the following criteria: carcinogenic (category 1A and 1B), mutagenic (category 1A and 1B), toxic for reproduction (category 1A and 1B), persistent, bioaccumulative and toxic, very persistent and very bioaccumulative or has comparable properties of concern (e.g. endocrine-disrupting or ozone-depleting).

**Substitute It Now (SIN) lists:** The International Chemical Secretariat (ChemSec), a non-governmental organization (NGO), has made it its mission to accelerate the replacement of hazardous chemical substances. With this purpose in mind, ChemSec publishes the SIN list, a directory of all substances that products should not contain according to ChemSec's evaluation.

**Sustainable by design:** A holistic approach taken by the European Commission that incorporates the following aspects: safety, circular economy, energy efficiency and functionality of chemicals, materials, products and processes during their entire life cycle and to minimize the environmental footprint.

**Sustainable Development Goals (SDGs)/Agenda 2030:** The 17 goals for sustainable development are political objectives of the United Nations (UN). They were adopted in 2015 and are intended to help ensure sustainable development worldwide on an economic, social, and environmental level.

**Technical cycle:**[1] The most effective way of preserving products' value in the technical cycle is to maintain and reuse them. When the product can no longer be used, its components can be reprocessed. Parts that cannot be reprocessed can be broken down into their components and recycled. Although recycling is the last resort given that the value of the products and components is lost, it is crucial as it is the last step that allows materials to remain in the economy and not end up as waste.

**Water risk:**[2] refers to the risk of an enterprise experiencing challenges such as water scarcity, flooding, infrastructure decay or drought.

**Water stewardship:**[3] Defined as the use of water that is socially and culturally equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process that includes both site- and catchment-based actions.

**(Current) water stress:**[2] refers to the ability – or lack thereof – to meet the human and ecological demand for freshwater. In addition to freshwater availability, it also takes into account the quality and accessibility of water. The WWF has developed a water risk filter containing five different water stress categories.

**(Future) water stress:**[4] A distinction is made between current and future water stress. To determine future water stress, we have used the pessimistic, ten-year scenario (based on the Aqueduct Water Risk Atlas). It assumes as standard a high rate of population growth and a low rate of urbanization.

**Water stress score:** The average value of current and future water stress.

**Water withdrawal:**[5] Sum of all water drawn from surface water, groundwater, seawater, or a third party for any use over the course of the reporting period.

[2] Sources: UNGC, CEO Water Mandate and WWF, Water Risk Filter.
[3] Source: Alliance for Water Stewardship (AWS), International Water Stewardship Standard v2.0, March 2019
[4] Source: World Resource Institute, Aqueduct projected water stress country ratings.
[5] Source: GRI 303: Water and effluents (2018)

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www.lanxess.com

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