The environment

Protecting our environment and the climate are major global challenges of our time. Maintaining the natural basis of life for future generations is part of our corporate responsibility. This also includes continuously reducing emissions in keeping with our sustainable corporate strategy.

MATERIAL TOPICS

- Green energy
- Mitigating climate change
- Biodiversity
- Water management

SDGS OF PARTICULAR RELEVANCE FOR EVONIK

-15% Reduction in absolute scope 1 & 2 greenhouse gas emissions [1]

-17% Reduction in absolute scope 3 greenhouse gas emissions [1, 2]

-410 kt p.a.
CO_2 reduction with power from certified sustainable sources

[1] Reference base: 2021.

[2] Scope 3 emissions from all upstream categories and the category "Downstream transportation and distribution" as defined in our SBTi target.

Contents

The environment

- **Climate targets validated by SBTi**
- **Long-term power purchase agreements for wind energy and solar power**
- **Significant increase in green electricity**
- **New climate and water policies**
- **Extension of our water and biodiversity analyses**

The environment

Strategy and management

As a specialty chemicals company, we are aware that our production impacts the environment. To minimize the impacts, we set ambitious targets and put many measures in place. According to our materiality analysis, the most important sustainability issues for Evonik include mitigating climate change, green energy, water management, and biodiversity.

Our actions are based on an extensive, integrated management system for the environment, safety, health, and quality. This applies to the whole of the Evonik Group and is based on legal requirements, internal policies, and standard operating procedures. In addition to meeting compliance requirements, we therefore support a targeted improvement in our environmental performance. Furthermore, we require our manufacturing sites to be validated as conforming to ISO 14001, the internationally recognized environmental management standard. In the energy sector, we have used an ISO 50001-certified energy management system for many years. This is currently being transferred stepwise to a digital system p. 55.

The ESHQ (Environment, Safety, Health & Quality) function has a central audit system to regularly monitor the implementation of our strategy and management system. Based on the findings and analyses of internal and external audits and site inspections, talks are held on possible improvements and ways of implementing them. The executive board is informed annually of the outcome of the audits. The processes used to collect and process environmental data are subject to internal and external audits. Our high quality standards are backed up by regular training. Data input is decentralized, and the data can be evaluated on the basis of management units, legal structures, or regions.

In 2023, we completed the introduction of our global ESHQ software, ESTER (Evonik Standard Tool ESHQ and Reporting), and integrated a further module to systematically record environmental data on scope 1 and 2 emissions. ESTER replaces the SuRe 2.0 sustainability reporting software that we used for many years. Our environmental data for 2023 are reported entirely using ESTER for the first time. That greatly improves data quality and allows timely evaluation. In 2024, we plan to record all internal and external audits for matrix certification in the ESTER tool.

This will further harmonize processes and systems and therefore contribute to enhanced efficiency. You can find further information and details of the principles we use to capture environmental data in "About this report" p. 149.

The ESHQ function bundles all group-wide strategic management and coordination activities relating to the environment, plant safety, occupational safety, and health. The global strategy for the safety area of action is defined by the HR Executive Committee, which comprises the chief human resources officer, the HR partners of the divisions, and the heads of the ESHQ, Sustainability, and HR Business Management functions. Decisions on the implementation of this strategy are taken by the ESHQ panel. Its members are representatives of the divisions, regions, technical committee, and employee representatives. The panel is chaired by the head of the ESHQ function, who reports directly to the chief human resources officer. Management and decision-making for the environment area of action are assigned to the sustainability council and the sustainability circle. The Sustainability and ESHQ functions work together closely to prepare and implement the work of the sustainability council and the sustainability circle (see "Further elements of our sustainability management" p. 135). GRI 303-1, 303-2, 306-1, 306-2

Certification

Our divisions and regions are subject to annual audits to monitor compliance with DIN EN ISO 14001 and RC 14001 validation at our production locations. In 2023, we conducted 101 internal and external ESHQ audits worldwide. The proportion of output covered varies from year to year because of the addition of newly acquired units, but so far it has always been between 95 and 100 percent.

Mitigating climate change

Strategy and management

Mitigating climate change—which is one of our material topics—and the related extreme weather events are a major challenge for society and one that we are also addressing. We are driving forward the reduction of all climate-relevant emissions and other environmental impacts of our business activities. To actively mitigate the effects of climate change, we set ambitious new targets in 2022. We have also integrated reducing our CO_2 emissions (scope 1 and 2 emissions) into the remuneration of the executive board and other executives. Carbon pricing is used as an additional planning criterion in investment decisions. Along the value chain, we are working on innovative solutions to reduce emissions—often in collaboration with suppliers and customers. Moreover, we started work on a climate transition plan in the reporting period.

The main lever to reduce GHG emissions is our own production. In addition, compared with conventional alternatives, many of our Next Generation Solutions make a further contribution at the application stage (see "Strategy and growth" p. 14).

Climate targets 2021 – 2030

In 2022, Evonik announced its commitment to the Science Based Targets initiative (SBTi). SBTi is a partnership of CDP, the United Nations Global Compact, the World Resources Institute, and the World Wide Fund for Nature. It defines and encourages best practices for science-based target setting and independently evaluates targets set by companies from this perspective. It has now become an internationally accepted standard.

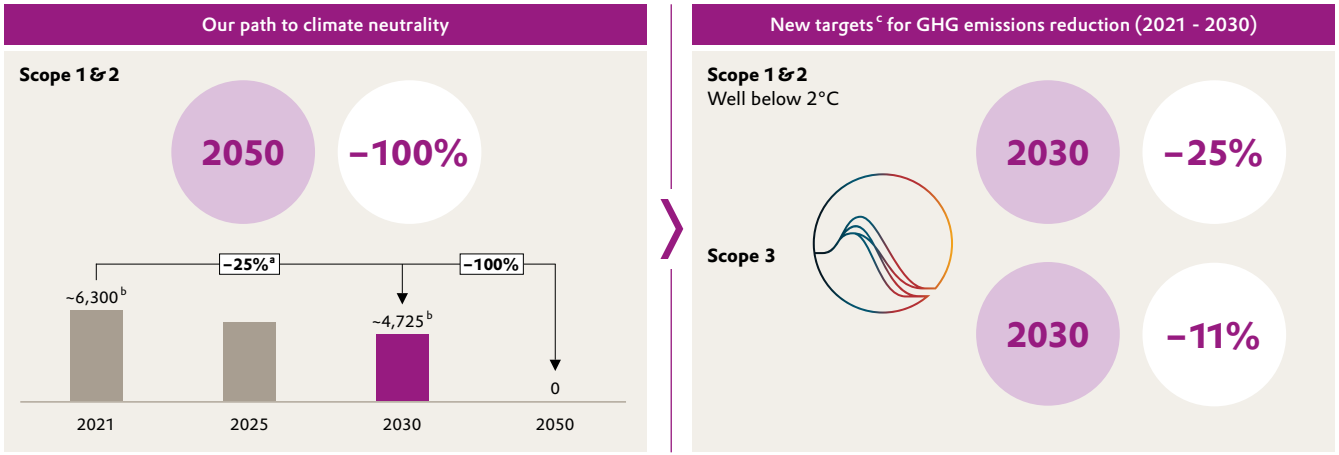
In the reporting period, the emission reduction targets submitted by Evonik were successfully validated by the SBTi. It confirmed that the ambitious target set for scope 1 and 2 emissions is suitable to help reduce global warming to well below 2° C. Our overriding target is to reduce scope 1 and 2 emissions by 25 percent between 2021 and 2030. In addition, Evonik has given an undertaking to reduce scope 3 emissions in all upstream categories and the category "downstream transportation and distribution" by

Our levers [a] to reduce GHG emissions along the value chain C13

Upstream	Gate-to-gate	Downstream
• Projects with key suppliers • Using climate-neutral instead of fossil-based raw materials • Closed-loop material flows; raw materials from recyclate	• Integrated facilities to use by-products • EAGER [b] project/Next Generation Technologies/ research • Green energy • Process efficiency • Sustainable data management	• Next Generation Solutions • CO_2e avoided by using Evonik products • Products to support a circular economy

[a] Examples.
[b] EAGER = **E**vonik **A**ssessment of **G**reenhouse Gas **E**mission **R**eduction.

Ambitious climate targets 305-1, 305-2, 305-3 C14



[a] Gross emissions; base year 2021, target year 2030.
[b] In thousand metric tons CO_2e.
[c] Validated by SBTi sciencebasedtargets.org/companies-taking-action#dashboard

11 percent[1, 2, 3] You can find an overview of our climate-related targets in C14.

To achieve our ambitious scope 1 and 2 target, we have put in place a wide range of measures. These include exiting coal-fired power generation at our site in Marl (Germany), ongoing global development of production processes and infrastructure (Next Generation Technologies), and a stepwise switch to renewable energy. In this way, we are also contributing to achieving the Paris Agreement on Climate Change.

In 2022, the EAGER project identified the potential to reduce GHG emissions at our sites. A cross-functional team identified scope to reduce CO_2e (scope 1 and 2 emissions) at the top 20 sites around the world by around 1 million metric tons (including the related costs of emissions avoidance), in accordance with the "well below 2° C" target. The top 20 sites account for 80 percent of Evonik's GHG emissions[4]. In the period to 2030, we plan to invest €700 million in Next Generation Technologies, in other words, in the ongoing development of production processes and infrastructure to reduce GHG emissions. In the reporting period, Evonik invested around €81 million in EAGER projects. Our aim is to reduce scope 1 and 2 CO_2 emissions by 170,000 metric tons CO_2e p.a. from 2026. For example, we are investing in the construction of a new facility in Singapore for carbon-neutral production of alkoxides.

In view of the geopolitical situation, we could not decommission the coal-fired power plant in Marl (Germany) as planned in 2022. Due to the consequences of Russia's invasion of Ukraine, we are required to retain the capacity until the end of March 2024 to safeguard the general reliability of supply. In this way, we secured the supply of electricity, heat, and steam to the site. We nevertheless assume that we will be able to achieve our scope 1 and 2 emissions reduction target for the period between 2021 and 2030.

Measures to reduce scope 3 emissions between 2021 and 2030

Reducing scope 3 emissions is challenging for the entire value chain because these emissions are outside our direct sphere of influence and are affected by many external factors. That necessitates intensive cooperation with partners along the value chain.

[1] Exact target: 11.07 percent.
[2] Based on greenhouse gas emissions from our sites in 2021.
[3] Some emissions fall within the scope of the SBTi criteria for the electricity sector and are therefore covered by different intensity targets. The exact wording of the Evonik emission reduction targets validated by SBTi can be viewed at sciencebasedtargets.org/companies-taking-action#dashboard
[4] Based on greenhouse gas emissions from our sites in 2020.

We analyze which raw materials and suppliers offer us the greatest potential for reduction. The starting point comprises secondary data from databases but also, increasingly, primary data. To increase the proportion of primary data, we contact our key suppliers once a year. In this context, we discuss, among other things, the main ways we can leverage emissions reduction with our suppliers. That may be renewable energies, improved processes, or alternative raw materials. Taking the overview of all factors, we then discuss specific targets with our suppliers. In this way, we support our customers' focus on reducing carbon emissions and circularity.

The short-term availability of low-carbon raw materials is limited. Therefore, we also use detailed mid- and long-term scenario analyses for the alignment of our procurement strategies. Green hydrogen is expected to drive the energy transition in the area of raw materials. That opens up opportunities for the production of green ammonia and green methanol. In the methanol process, CO_2 removal is possible, so the product would have a negative carbon footprint. Evonik is monitoring these developments and is in close contact with potential suppliers. Since ammonia can be used as a transport medium for hydrogen and as a substitute for marine diesel, we assume that the development here will be faster than for other raw materials.

A first step towards reducing our scope 3 emissions is the use of green C4 crack, which is produced from green naphtha in Marl (Germany). There are signs of a significant increase in volumes, especially of biomethanol, which is used to produce MTBE (methyl-tert.-butylether). In addition, green acetone is used to produce sustainable isophorone products. As an additional measure, in the reporting period, we started to procure inorganic raw materials produced using green electricity. We have also extended certification under the mass balance standard of the Roundtable on Sustainable Palm Oil (see "Value chain and products" p. 37). Process improvements on the supplier side can therefore be reported as a scope 3 measure thanks to the improved data transparency resulting from various supplier commitments.

Moreover, in the reporting period, for the first time, we were able to report measures to reduce CO_2 in the procurement of logistics services and packaging. Based on initial pilot talks with selected logistics providers, we have been able to alter our calculations to integrate measures that our suppliers are planning or have already implemented to reduce CO_2. Examples of savings are switching to intermodal transportation or using HVO[1] as a substitute for diesel fuel in road transportation (see "Transportation safety and logistics" p. 108). In addition, our supplier engagement program has been extended to include selected indirect suppliers in order to check the availability of primary data and the inclusion of potential measures to reduce CO_2.

Validation of our climate targets by SBTi gives us the assurance that we are heading in the right direction. They are an incentive for us to work towards a further significant reduction in our emissions in the future as an important contribution to limiting global warming.«

Holger Höcker | Vice President Safety, Strategy & Controlling, ESHQ, Germany

Mitigating climate change

Outlook 2030 – 2050

On our climate journey, we are currently focusing on reducing our scope 1 and 2 emissions. In the period to 2030, this will be leveraged principally by exiting coal-fired power generation, switching to green electricity, and increasing process and energy efficiency at our sites, especially by applying best practices. Our efforts will be supported by digital process technologies and the establishment of a sustainability data management system.

[1] Hydrotreated vegetable oil; corresponds to biodiesel produced entirely from waste and residues.

Looking beyond 2030, we see broadening our technology and raw material portfolios as the key drivers of our transformation. We anticipate that the availability of alternative raw materials will improve significantly and drive forward circularity. From 2035, we expect new technologies to reach maturity, one example being the widespread availability of green hydrogen. In the following years, we expect to see the breakthrough of processes such as carbon capture and storage (CCS) and carbon capture and utilization (CCU). Carbon capture and utilization technologies are a possible way of reducing the consumption of fossil fuels and avoiding CO_2 emissions. Together with partners, we are engaged in research in this field to improve our understanding of the interaction of such technologies with our portfolio of specialty chemicals under market conditions. For instance, our expertise in catalyst research offers the possibility of using the stable CO_2 molecule in combination with green hydrogen and renewable energies to generate a higher quality product. Following chemical conversion, CO_2 counts as a raw material and no longer as waste. This could enable the production of methanol and other hydrocarbons for use in products such as solvents, fertilizers, polymers, and liquid e-fuels. The use of CO_2 for e-fuels will be further strengthened by the ReFuelEU regulations for aviation[1]. We are supporting these projects and are in close contact with those involved in the relevant stages of the value chain.

Task Force on Climate-related Financial Disclosures

A cross-functional working group at Evonik is following the objectives of the Task Force on Climate-related Financial Disclosures (TCFD) very closely. The TCFD focuses on climate reporting by companies and their climate-related opportunities and risks. We provide an overview of climate-related information in the categories governance, strategy, risk management, and metrics and targets in line with the TCFD structure (see "Basis of reporting" p. 151). The executive board receives regular updates on climate-related opportunities and risks as part of our group-wide opportunity and risk management. In October 2023, TCFD considered that it had fulfilled its purpose and was therefore disbanded. In the future, companies' progress will be monitored by the IFRS Foundation. 201-2

Evonik is a member of the climate protection platform Chemistry4Climate—a joint initiative of the German chemical industry association (VCI) and the association of German engineers (VDI). The aim of this dialogue platform, which comprises around 70 partners from industry, NGOs, and politics, is to come up with practical ideas on how the chemical industry and other sectors can move towards defossilization by 2045. Chemistry4Climate supports Germany as an industrial base and promotes a fairer world, where value chains are viewed globally, and partner regions are given a fair share as advocated by the UN Sustainable Development Goals (SDGs).

Greenhouse gas emissions

The standard used to report our GHG emissions is the Greenhouse Gas (GHG) Protocol Standard. We distinguish between direct scope 1 emissions from energy generation and production and indirect scope 2 emissions from the purchase of electricity and steam. Purchased electricity is calculated by the market-based method using the individual emission factors of the power suppliers.

Greenhouse gas emissions

305-1, 305-2, 305-4, 305-5, 305-6, 305-7 — T05

in thousand metric tons CO_2e[a,b]	2021	2022	2023
Scope 1			
Gas	1,881	1,892	1,871
Coal	1,275	1,127	926
Oil	8	7	5
Substitute fuels and process emissions	1,168	1,137	985
Methane (CH_4)[c]	13	22	21
Dinitrogen oxide (N_2O)[c]	12	17	18
Hydrofluorocarbons (HFCs)	25	19	17
Total	4,381	4,221	3,842
Scope 2			
Purchased electricity[d]	979	905	801
Purchased steam	937	852	736
Total	1,916	1,757	1,537
GHG emissions, total scope 1 & 2	**6,297**	**5,978**	**5,379**
Reduction in GHG emissions versus 2021 in %	**0**	**–5**	**–15**

[a] The calculation of greenhouse gases as CO_2e is based on the Sixth Assessment Report IPPC AR6 (2021) and is based on a period of 100 years.

[b] Adjusted presentation of the results in accordance with the GHG Protocol Standard.

[c] Emissions from production and energy generation.

[d] Market-based method using individual emission factors of electricity suppliers.

[1] consilium.europa.eu/de/press/press-releases/2023/10/09/refueleu-aviation-initiative-council-adopts-new-law-to-decarbonise-the-aviation-sector/

Global demand remained weak overall in 2023 in challenging economic conditions, and production contracted by 10 percent year-on-year to 7.5 million metric tons. That was also one of the main reasons for the sharp drop in scope 1 and 2 GHG emissions, which also fell by 10 percent in the reporting period. Other reasons for the reduction were increased purchasing of electricity from renewable resources ("Green energy" p. 54) and the mode of operation of the power plants in Marl (Germany). Significantly less coal was used at the coal-fired power plant as block 4 was taken out of service in April 2023, and there was a long maintenance shutdown at block 5 in the second half of the year.

The requirement to extend the operation of the coal-fired power plant at this site, which was imposed to safeguard general supply as a result of the geopolitical situation, expires at the end of March 2024. Worldwide, Evonik will then no longer generate any electricity from coal.

In 2023, Evonik had 26 (2022: 24) facilities that fell within the scope of the EU Emissions Trading System (EU ETS). In total, these EU ETS facilities emitted 2.5 million metric tons CO_2 in the reporting period (2022: 2.8 million metric tons CO_2). Moreover, we are subject to carbon pricing systems in a number of countries. In Germany and Austria, we are subject to national emissions trading systems in addition to the EU ETS. In the provinces of Fujian and Shanghai in China, our Nanping and Shanghai sites are subject to regional emissions trading systems. National emissions trading systems apply for our sites in Morrinsville (New Zealand) and Ulsan (South Korea). Our sites in Gibbons and Maitland (Canada) and Singapore are subject to the relevant national CO_2 taxes. Overall, about 78 percent of GHG emissions were subject to carbon pricing systems in 2023.

Carbon pricing

We use internal carbon pricing for major investments as a basis for effective management of our CO_2 reduction target. The aim is to be able to reflect the development of carbon-intensive investments in a reliable and harmonized manner in all investment applications worldwide. At present, we assume that the carbon price for the EU ETS will be €142 per metric ton CO_2 up to 2030. In all other regions of relevance to Evonik, we have altered our forecast to €40 per metric ton CO_2 by 2030 at the latest. This reflects the development of the political framework in key emerging markets and developing countries, which does not currently indicate an increase in carbon pricing.

In view of regional differences in the starting situation, we have developed scenarios for the development of carbon pricing—differentiated by countries and regions—showing the rise to the assumed final global price. In these, we take into account both direct CO_2 emissions (scope 1 emissions) from production and energy generation and indirect CO_2 emissions from the purchase of secondary fuels (scope 2 emissions).

Furthermore, we use a CO_2 cost calculator that allows efficient and systematic calculation of the CO_2 costs to be taken into account in every investment. Since it provides site- and fuel-specific emissions factors and regional scenarios for the development of carbon pricing, it permits harmonized evaluation of the CO_2 cost of investments throughout the Evonik Group.

Evonik Carbon Footprint

We pay special attention to greenhouse gas emissions along the value chain. Since 2008, we have reported an extensive overview of greenhouse gas emissions—from the extraction of raw materials through production to the disposal of the products. The key parameter is the carbon footprint (CO_2e footprint). The data cover Evonik's direct energy and process emissions (scope 1), emissions from purchased electricity and heat (scope 2), and relevant upstream and downstream emissions (scope 3). These include emissions from the production of purchased raw materials, services, and capital goods, energy-related emissions not included in scope 1 and scope 2, emissions from inbound and outbound shipments, from the disposal of waste, emissions caused by business trips and employee commuting, energy requirements for administrative buildings, and emissions from the use, disposal, and recycling of sold products. The method is closely based on the GHG Protocol Standard of the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), as well as the Guidance for Accounting & Reporting Corporate GHG Emissions in the Chemical Sector Value Chain published by the WBCSD.

Evonik Carbon Footprint[a] 305-3, 305-5 **T06**

Greenhouse gas emissions in million metric tons CO_2e		2021	2022[c]	**2023**[d]
Scope 1	Direct energy- and process-related emissions	4.4	4.2	3.8
Scope 2	Indirect emissions from purchased energy (gross, market-based approach)	1.9	1.8	1.5
Scope 3[b]	Category 1: Purchased chemical raw materials, packaging materials, and indirect goods and services	13.0	11.2	10.6
	Category 2: Capital goods	0.3	0.3	0.4
	Category 3: Energy-related activities (not included in scope 1 and 2)	1.7	1.5	1.0
	Category 4: Upstream transportation and distribution	1.1	1.0	1.0
	Category 5: Disposal and recycling of waste	0.3	0.3	0.3
	Category 6: Business travel	0.01	0.03	0.02
	Category 7: Employee commuting	0.06	0.05	0.04
	Category 8: Upstream leased assets (company cars, electricity and heating of administrative buildings)	0.00	0.00	0.00
	Category 9: Downstream transportation and distribution (to direct customers)	0.05	0.04	0.04
	Category 11: Use of sold products (direct emissions only)	4.2	3.1	3.2
	Category 12: Disposal and recycling of products	2.8	3.0	2.7
Reduction in scope 3[e] GHG emissions versus 2021 in %		**–**	**– 13**	**– 17**
GHG emissions, total scope 3		**23.4**	**20.5**	**19.2**
thereof upstream		*15.3*	*14.4*	*13.3*
thereof downstream		*6.3*	*6.1*	*5.9*
GHG emissions Evonik Carbon Footprint (sum of scope 1, 2, and 3)		**29.7**	**26.5**	**24.6**

[a] The fast close process reporting was used for this reporting period, see "About this report" **p. 149.** Differences between the data and totals are due to rounding. The inventory covers fossil greenhouse gas emissions and emissions of gases—other than CO_2—of biogenic origin. Moreover, scope 3 categories 1 (–1.3 million metric tons biogenic CO_2e), 11 and 12 (approximately +0.8 million metric tons biogenic CO_2e together), and direct scope 1 process emissions (+1.0 million metric tons CO_2) entail relevant use of biomass with the associated net amounts of CO_2 removal and biogenic CO_2 emissions. In the past, the net biogenic amounts were: scope 3 category 1 approximately –1.4 (2021) / –1.3 (2022) million metric tons CO_2; scope 3 categories 11 and 12 together approximately +1.0 (2021)/+0.9 (2022) million metric tons biogenic CO_2. The corresponding direct process emissions (scope 1) were constant at around +0.1 million metric tons CO_2 in 2021 and 2022.

[b] Some calculations are based on assumptions and estimates. Scope 3 category 10 "Processing of sold products" is not reported due to its complexity; categories 13 "Downstream leased assets," 14 "Franchises," and 15 "Investments" are not disclosed separately as they are not applicable or not significant.

[c] Since the economy was weaker in the second half of 2022 than in the first half of 2022, resulting in a reduction in production activity, emissions in the fourth quarter of 2022 were overestimated as the fast close process used a projection based on the first three quarters. As a result, the data for the full year had to be corrected. Therefore, the figures for 2022 in the present report differ from those reported in the sustainability report 2022.

[d] To calculate the emissions data for 2023, the IPCC AR6 - GWP100 impact assessment method (Sixth Assessment Report IPCC AR6 (2021), which is based on a 100-year period) was used where possible to determine scope 3 emissions, instead of the previous method developed by the University of Leiden (CML2001- Aug. 2016).

[e] Scope 3 emissions from all upstream categories and the category "Downstream emissions from transportation and distribution" as defined in our SBTi target.

The data in table **T06** cover fossil GHG emissions and biogenic GHG emissions other than CO_2. Net amounts from CO_2 removals (due to biological carbon sequestration by biomass at the beginning of the life cycle) and biogenic CO_2 emissions are reported separately.

The development of our direct energy- and process-related emissions, our indirect emissions from purchased energy, and greenhouse gas emissions along our value chain, including the contribution made by the individual categories in the GHG Protocol Standard, are presented for 2021 (baseline), 2022, and 2023 in table **T06**.

In 2023, greenhouse gas emissions decreased to 24.6 million metric tons CO_2e, compared with 26.5 million metric tons CO_2e in 2022. This was mainly due to a cyclical reduction in business activities, which was reflected in lower procurement, production, and sales volumes.

Other emissions into the air

Alongside emissions of greenhouse gases as reported above, energy generation and industrial production result in further emissions into the air. We want to reduce these further and therefore take the emissions situation into account when planning new facilities. Our clean air measures include returning exhaust gases to the production process, thermal processing of residual gases with a high calorific value (as substitutes for natural gas), the use of electric filters to remove particulates, the use of catalysts to reduce nitrogen oxide, and desulfurization by washing with subsequent precipitation. We also use other methods to reduce emissions from production facilities. Examples are wet and dry scrubbing, condensation, adsorption, and thermal and catalytic incineration. Some of these emissions treatment facilities are used simultaneously by several units.

Other emissions into the air 305-6, 305-7 **T07**

in metric tons	2022	2023
Carbon monoxide (CO)	800	803
Sulfur oxides (SO_x/SO_2)	1,185	1,027
Nitrogen oxides (NO_x/NO_2)	3,192	2,803
Non-methane volatile organic compounds (NMVOC)	994	741
Particulates	449	484
Heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn)	0.31	0.26
Ozone-depleting substances[a] in metric tons CFC-11 equivalents	0.30	0.29

[a] Emissions of ozone-depleting substances calculated in accordance with the Montreal Protocol.

The other emissions into the air declined in 2023 as a result of lower production output and the reduced use of coal for energy generation at Marl Chemical Park. The coal-fired power plant in Marl will be finally decommissioned at the end of March 2024 in accordance with the statutory requirements. That will bring a significant reduction in emissions into the air (excluding greenhouse gas emissions). Based on the data for 2023, we assume the following reductions:

- Nitrogen oxides (NO_x/NO_2): –1,000 metric tons
- Sulfur dioxide (SO_x/SO_2): –500 metric tons
- Particulates: –25 metric tons
- Heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn): –0.05 to –0.07 metric tons

305-6, 305-7

Very low level of ozone-depleting substances

The ozone-depleting chlorofluorocarbons (CFCs) are presently only used as refrigerants on a very restricted basis as a transitional solution in line with national and international regulations. Emissions of ozone-depleting substances fluctuate at a low level due to aperiodic replenishment of refrigerant systems. Consequently, they were again very low in 2023. The main substitutes at present are partially fluorinated hydrocarbons (HFCs), which are used in decentralized air-conditioning systems and small process cooling systems. These substances do not harm the ozone layer, but they have a significant impact on the climate. We anticipate that these refrigerants will be replaced by more climate-friendly products in the mid-term. The greenhouse gas potential of the refrigerants is shown in table "Greenhouse gas emissions" T05 p. 51.

Green energy

Strategy and management

Green energy is one of Evonik's three most important material topics. In the reporting period, we made good progress with the strategic transformation of Evonik in this area. The focus at our sites is clearly defined: In the long term, supply will be switched to energy from renewable resources. More than 50 sites in Europe, Asia, and North and South America currently source or generate sustainable energy. That avoids around 410,000 metric tons of CO_2 a year. Our energy management system ensures a continuous and lasting increase in energy efficiency. We have already optimized more than 80 percent of our global energy requirements using an ongoing, certified process.

Significant increase in the proportion of green electricity

In the future, our European sites will be far less dependent on fossil fuels. In 2022, we signed a long-term power purchase agreement (PPA[1]) with EnBW for the supply of green electricity from the planned 960 Megawatt (MW) He Dreiht offshore wind farm, starting in 2026. Further PPAs were concluded in December 2023. From 2025, Evonik will source electricity from Vattenfall under a ten-year PPA. This will come from the approximately 120 MWp[2] installed capacity at the locations that are being erected in northern Germany. Furthermore, under a ten-year PPA with RWE, from 2028, we will be sourcing approximately 37.5 GWh p.a. green electricity from the Kaskasi offshore wind farm, which started operating in 2023. These long-term agreements ensure the financial viability and realization of these projects and help advance the energy transition. Evonik compensates for fluctuations in the wind energy and solar power feed-in through its own balance group management. This shows that we have a keen eye on the reliability of supply, can avoid potential bottlenecks, and safeguard the long-term operation of our production facilities.

[1] PPAs are long-term power supply agreements between a producer (e.g., a wind farm operator) and a major customer (e.g., an industrial company).
[2] MWp = Megawatt peak.

Worldwide, about 35 percent of electricity purchased by Evonik from external suppliers already comes from renewable sources. By 2030, we want to switch to green sources for 100 percent of purchased electricity. The PPAs with EnBW, Vattenfall, and RWE in Germany will increase this to well over 50 percent. At the same time, these agreements will reduce scope 2 emissions (purchased power) by about 150,000 metric tons CO_2 a year. Our goal is to reduce scope 1 and 2 emissions from 6.3 million metric tons to 4.7 million metric tons between 2021 and 2030 **C14** **p. 49**. About one-third of this reduction should be achieved by using renewable energies.

In addition to green electricity, biomethane is becoming increasingly important for Evonik as a substitute for fossil-based natural gas. Our production facilities in Schörfling am Attersee (Austria) already operate entirely with energy from renewable resources. These production facilities for SEPURAN® membranes run exclusively off green electricity from wind, hydroelectric power, and biomass. Moreover, since the beginning of 2022, this site's gas requirements have been fully met by locally produced biomethane. By switching to environmentally friendly energy supply, Evonik has reduced direct CO_2 emissions at this plant in Upper Austria by about 5,000 metric tons a year. Moreover, since 2021, the High Performance Polymers business line has used biomethane for the manufacture of certain products in Germany. Since May 2023, biomethane has been used to produce steam at the Health Care business line's site in Ham (France.)

302-1, 302-4, 305-1, 305-2, 305-3, 305-4, 305-5, 305-6, 305-7

Energy management systems and measures to increase energy efficiency

Evonik aims to reduce both absolute and specific energy consumption by 5 percent by 2025 (baseline year: 2020). New technologies and efficient processes will pay a part in this. For example, our digital energy management system (DEnMS) supports the achievement of operational energy targets at our sites. In 2022[1], successful energy efficiency activities led to a reduction of more than 380 GWh in energy consumption, as well as reducing emissions by around 1 million metric tons CO_2, compared with 42,000 metric tons CO_2 in the previous year. This was due to the switch from coal to natural gas following commissioning of the highly efficient gas and steam turbine power plants at our site in Marl (Germany).

See our special magazine section
p. 69.

Green energy

In 2023, we successfully had further sites in Europe, North America, Brazil, and China certified as conforming with ISO 50001. Our certified energy management system now includes 57 sites, and ISO 50001 certification is planned for further sites in the coming years. Our aim is for certification to cover more than 90 percent of Evonik's global energy consumption by 2026. While absolute energy consumption at the ISO 50001-certified sites was reduced by 2.8 percent between 2020 and 2022, we registered a 3.4 percent rise in specific energy consumption in this period. The main reason for this was the cyclical drop in production volumes. Lower capacity utilization at production facilities often reduces their energy efficiency.

The energy efficiency measures implemented in 2022 included the following measures, which resulted in considerable energy savings:

- Commissioning of the new, highly efficient gas and steam turbine power plants in Marl (Germany) (project AS20+; energy savings: approx. 97 GWh p.a.)
- Use of innovative advanced process control (APC) systems in various plants in Marl and Wesseling (Germany) (energy savings: approx. 150 GWh p.a.)
- Use of exhaust heat from flue gas in Rheinfelden (Germany) (energy savings: approx. 6 GWh p.a.)

[1] Data for 2023 will not be available until summer 2024.

The energy management system is being switched stepwise to a uniform digital basis for all sites, supporting all steps from energy data capture through data analysis to monitoring the action taken. The benefits of the digital energy management system (DEnMS) are increased global data transparency and, in particular, faster, automated availability of real-time data at plant level.

Regular exchange formats ensure that the specialists for production, sustainability, and energy efficiency at our sites and in the divisions, functions, and regions share experience to strengthen the global best practice network. Networking is supported by the continuous expansion of our global knowledge platform on the energy management system. 302-1, 302-4

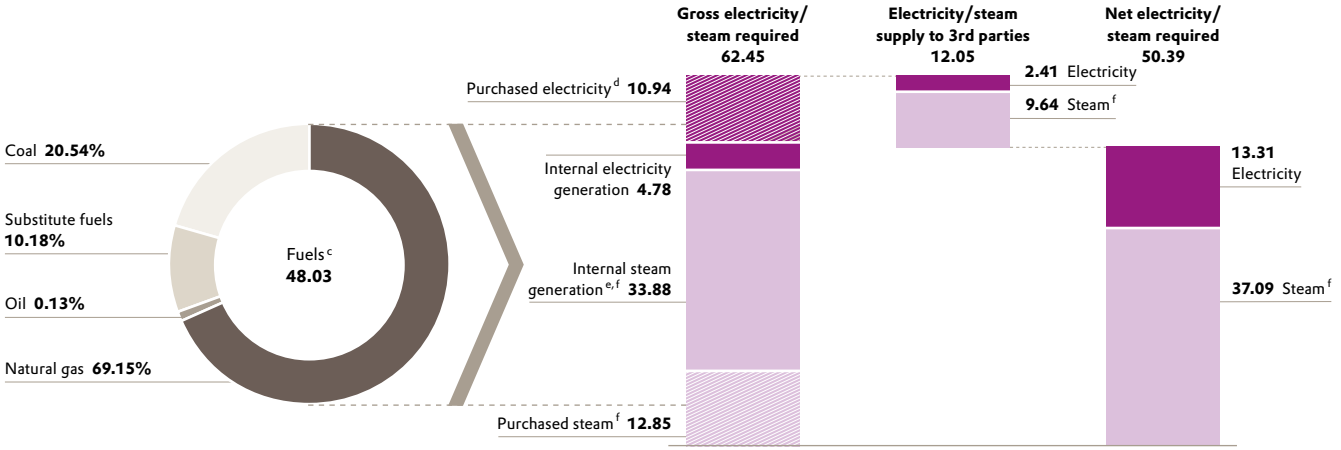
Energy data

In our energy reporting, we distinguish between primary energy inputs, generally fossil fuels used to generate electricity and steam, and secondary energy inputs. These mainly comprise purchased electricity and steam. We also use substitute fuels such as thermal processing of by-products, waste, and sewage sludge.

At present, natural gas and coal are Evonik's main fuels. The coal-fired power plant in Marl (Germany) will be decommissioned at the end of March 2024. That will end coal-fired power generation by Evonik worldwide. Coal will then be a negligible component of our energy mix.

In addition to natural gas-fired generation of electricity and steam for captive use, large amounts of process heat from exothermic reactions, for example, from the production of acrolein, are used in integrated heating systems.

Evonik's energy data 2023 [a, b] 302-1, 302-4 C15



[a] In petajoules.
[b] Contains the energy required to generate refrigerants. Does not include cooling energy sold to third parties.
[c] Fossil fuels and substitute fuels used by Evonik for internal energy generation.
[d] Excluding trading and excluding supply of purchased electricity to third parties in Germany.
[e] Including process heat, e.g., from acrolein production.
[f] Conversion factor: 2.8 * 10^{-6} PJ per metric ton steam.

Thanks to the coordinated operation of the power plants in Marl, there was a stronger shift in our energy mix towards natural gas in 2023. Increased use was made of the new, highly efficient gas and steam turbine power plants. Together with the higher availability of the power plants and the actual market prices, there was a significant rise in power sold to third parties. There was a significant reduction in the availability of substitute fuels due to the substantial drop in production activity. Heating oil now only plays an insignificant role in the energy mix. It is only used for auxiliary firing systems in the coal-fired power plant I in Marl. Moreover, insignificant amounts are required for emergency generators at some sites. The change in absolute and specific net energy input versus 2020 mainly reflects the trend in production.

Energy inputs 302-1, 302-3, 302-4, 302-5 **T08**

in petajoules	2020	2022	2023
Total fuels	54.59	50.49	48.03
Natural gas	*30.42*	*33.12*	*33.21*
Coal	*15.97*	*11.22*	*9.86*
Substitute fuels	*8.11*	*6.06*	*4.89*
Oil	*0.09*	*0.08*	*0.06*
Purchased electricity	9.17	10.70	10.94
Electricity sold	1.59	0.83	2.41
Purchased steam	12.84	13.78	12.85
Steam sold	10.10	9.51	9.64
Gross energy input[a]	76.59	74.96	71.82
Net energy input[b]	64.90	64.63	59.77
Change in net energy input versus 2020 in %	**0**	**0**	**–8**
Production in million metric tons	8.93	8.38	7.50
Specific net energy input in petajoules per million metric tons production	7.27	7.71	7.97
Change in specific net energy input versus 2020 in %	**0**	**6**	**10**

[a] Fuel inputs plus purchased electricity and steam.

[b] Fuel inputs plus purchased electricity and steam less electricity and steam supplied to third parties.

Water management

Strategy and management

We save water wherever possible and endeavor to achieve a further reduction in our emissions. In the reporting period, Evonik adopted a water policy and published it on its website. More . Our aim is to reduce specific freshwater intake by 3 percent relative to production volume between 2021 and 2030. This is to be achieved by a wide range of measures at our production sites. These measures were identified as part of the EAGER project p. 49. Integrated heat management measures can reduce the demand for cooling water, which in turn reduces the demand for freshwater. For example, our Active Oxygens business line has planned power-to-heat (PtH) projects for the period up to 2030. These include, for example, installing heat pumps in Europe, which should avoid around 35,000 metric tons of CO_2 and save more than 3 million m^3 of water a year. Process improvements help reduce freshwater intake. For instance, the Animal Nutrition business line has reduced water consumption by about 40 percent per metric ton of methionine at its facility in Mobile (Alabama, USA) by improving resource management at the site. In Antwerp (Belgium), Evonik is planning to use treated municipal wastewater instead of drinking water for its cooling towers in the future. Furthermore, there are plans to use the treated wastewater for steam generation, chemical processes, and in the desalination plants at this site. Based on full capacity utilization, this should allow savings of around 2.5 million m^3 of drinking water a year at this site from 2026 and reduce freshwater requirements by a further 10 percent. In view of this, the municipal water utility in Antwerp is planning to build a cooling water factory with several technology companies in the next three years to recycle and treat municipal wastewater.

We are also continuing our work on established water management topics, including monitoring our sites in water stress areas. Adequate availability of water for cooling and production processes plays a key role in our production activities. We therefore regularly analyze the short-, medium-, and long-term water risks at our sites. In the reporting period, we therefore widened our analysis of water stress at our sites to encompass a holistic assessment of water risks. We use the WWF[1] Water Risk Filter to analyze various physical risk aspects such as water stress, flooding, and water quality. In addition, we evaluate reputational risks, such as water conflicts and media scrutiny, and regulatory risks. Another focus is on the 2030 and 2050 time horizons, based on the TNFD[2] climate scenarios. The AWARE[3] method,

[1] World Wide Fund For Nature.
[2] TNFD = Task Force on Nature-related Financial Disclosures.
[3] AWARE = Available WAter REmaining.

Anaerobic processes for the treatment of process effluent and sludge with a high organic content use very little energy compared with incineration or aerobic biological treatment and generate virtually no residues for landfill. These methods also produce valuable biogas and reduce CO_2. We have developed a variety of concepts to implement this.«

Matthias Woyciechowski | Senior Expert Environmental Technologies, Germany

Water management

which we previously used to identify sites in water stress areas, has been integrated into the WWF Water Risk Filter. The water risk assessment looks at risks relative to the water basin and the type of water use at each site. Examples are particularly water-intensive processes. In the reporting period, we performed a full water basin assessment. We also started to assess water use by interviewing experts at our sites. We started with those sites that our water basin analysis identified as being in high-risk regions.

We use the WWW Water Risk Filter to determine the sites that are most affected by water risks. In the reporting period, we did not obtain a rating of very high or extreme for any of our 104 production sites. At five sites, water risk was classified as high. A further 47 sites are classified as medium risk in respect of the water basin. Ten of these are in the upper range (medium-high). The shift compared with the previous year (AWARE method) is attributable to the considerably wider scope of the WWF Water Risk Filter, which has a total of 12 risk categories. Risk category 1 (water scarcity) looks at six indicators, one of which is the AWARE approach. In addition, the WWF Water Risk Filter defines levels (extreme, very high, high, medium, etc.) to which the sites are allocated.

We also examined future risks for the 2030 and 2050 time horizons using the WWF Water Risk Filter, including analyses for the pessimistic, current trend, and optimistic scenarios. The pessimistic scenario is based on very conservative assumptions. On this basis, 19 sites would be classified as high risk in 2030 (but none as very high or extreme). In 2050, 23 sites would be classified as high risk and a further three as very high risk (but none as extreme risk). Analyzing our sites using the WWF Water Risk Filter helps us identify relevant water-related impacts, dependencies, and risks in order to derive and prioritize future measures. Furthermore, we are currently working on an approach to assign a monetary value to water risks.

In addition to the water risks outlined above, we perform a holistic risk analysis covering the additional potential impact of natural catastrophes such as storms, hail, floods, hurricanes, tornadoes, and torrential rainfall. Moreover, our sites are regularly audited by insurance companies. 303-1, 303-2, 303-3, 303-4, 303-5

Water data

Total water intake was 403 million m^3 in the reporting period, while discharges amounted to 397 million m^3. The difference of 6 million m^3 between water intake and discharge mainly comprises water used to replace evaporation losses. Around 98 percent of our total water intake of 1,724 million m^3 was for cooling purposes in energy generation and production. Only 2 percent (41 million m^3) was used for production purposes. We include

Water intake by source[a] 303-1 T09

in million m^3	2021	2022	2023
Drinking water[b]	20.7	20.6	19.0
Groundwater	56.6	51.7	46.7
Surface water	174.3	172.1	153.8
Recycling of water from third parties and use of rainwater	4.3	3.4	4.7
Total freshwater	**255.9**	**247.8**	**224.3**
Salt water (sea water)	206.0	196.6	179.0
Total	**461.9**	**444.4**	**403.2**
Production in million metric tons	**9.5**	**8.4**	**7.5**
Specific water intake intake in m^3 freshwater per metric ton production	**26.8**	**29.5**	**29.9**
Development of specific freshwater intake relative to the reference base 2021 in %	**0**	**10**	**12**

[a] Differences between the data and totals are due to rounding.
[b] Water from municipal or other utilities.

water used in closed cooling circuits and evaporation losses when calculating the proportion of total water used for cooling.

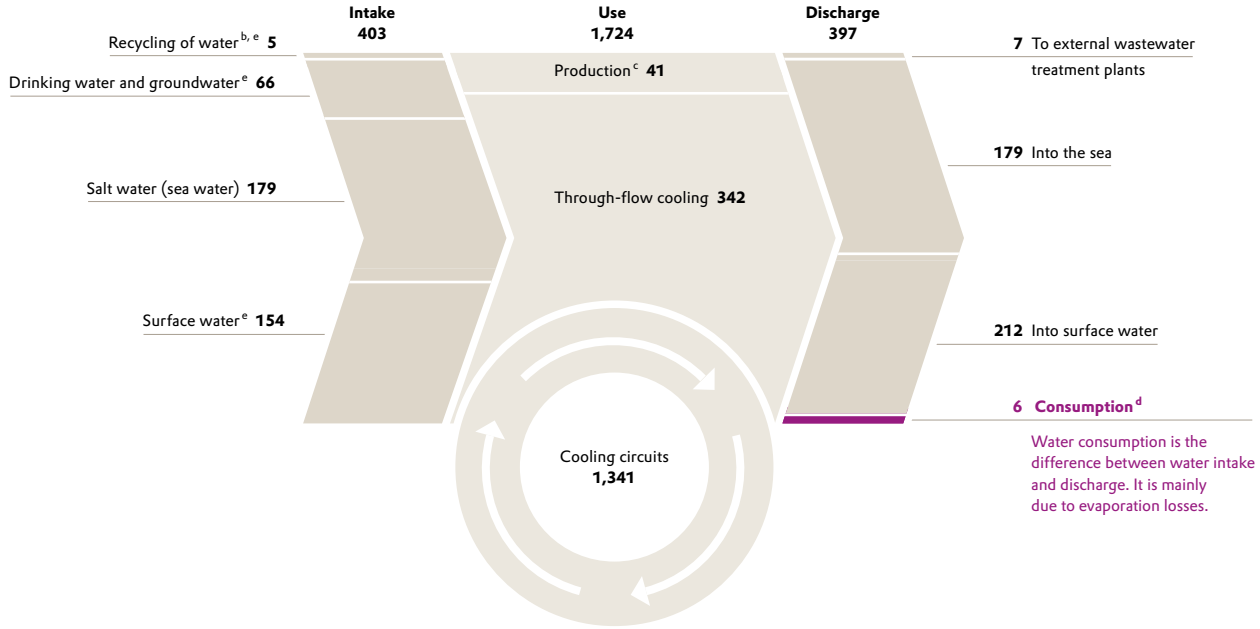
Evonik's consumption of freshwater—the total of recycled water from third parties, rainwater, drinking water, groundwater and surface water—declined by 10 percent to 224 million m^3 in the reporting period. The reduction in consumption of drinking water and surface water was mainly attributable to the reduction in production in 2023. The reduction in groundwater consumption was mainly due to the sale of the Lülsdorf site in Germany. The increase in recycling of water from third parties and use of rainwater was mainly due to increased rainfall in Marl (Germany) compared with the drought in 2022. The reduction in salt water intake in 2023 was due to a maintenance shutdown at a methionine plant on Jurong Island (Singapore) in the fourth quarter.

Emissions into water

Our sites aim to make a contribution to protecting natural water resources. When planning new production plants, we therefore consider the use of processes that generate little or no wastewater. Where contaminated water from production processes (production effluent) is unavoidable, partial streams are tested, for example, for biodegradability. We have high technology standards and infrastructure for the disposal of wastewater at our sites. In some cases, production effluent is pretreated in the production plants. Consequently, the effluent load of wastewater discharged into our own or third-party treatment facilities is moderate.

Evonik's water data 2023 303-1, 303-2, 303-3, 303-4, 303-5 C16

(in million m^3 p.a.)[a]



[a] Figures in the chart are rounded. | [b] Recycling of water from third parties, including use of rainwater. | [c] Water used in chemical processes, including generation of steam and water for sanitary purposes. | [d] Water consumption in accordance with GRI Standard 303-5 (2018). | [e] Freshwater.

At Marl Chemical Park in Germany, sewage sludge is dewatered in our own treatment plant and subsequently incinerated in our own facilities with integrated flue gas treatment. We use some of the exhaust gases from the production plants as substitute fuels. The incineration gases are then used to generate 20 bar steam. Wastewater discharged from our sites is carefully monitored, for example, by regular sampling and measuring equipment that operates continuously. These analyses support the management of our wastewater treatment facilities. Moreover, many analyses are required by legislation on self-monitoring. In addition, the authorities frequently perform unannounced checks to monitor discharges.

Wastewater loads[a] 303-2 T10

in metric tons	2022	2023
Chemical oxygen demand (COD)	1,433	1,316
Total nitrogen (N)	143	185
Total phosphorus (P)	33	37
Absorbable organic halogen compounds (AOX)	1.2	1.4
Heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn)	1.3	1.4

[a] Direct discharges only.

In 2023, we discharged a total of 397 million m^3 wastewater, including 7 million m^3, which was channeled to third-party facilities (e.g., municipal facilities) for treatment (indirect discharge). 47 million m^3 were discharged directly into water via our own drainage system after treatment in Evonik wastewater treatment facilities. These direct discharges also include amounts accepted from third parties for treatment at the wastewater treatment facilities operated by us at chemical parks. Since 2021, our external reporting has only disclosed the wastewater loads of direct discharges. In view of this, data from 24 direct discharge sources were included in the reporting period.

Organic substances—expressed as chemical oxygen demand (COD)—account for the highest proportion of our wastewater loads. COD is the concentration of all substances in the wastewater that can be oxidized under certain conditions. The decrease in COD was mainly attributable to the reduction in production. The increase in total nitrogen (N) emissions was caused by the temporary malfunctioning of one of our wastewater treatment plants.

Waste management

Strategy and management

Our efforts to further reduce production waste are aligned with a clear principle: the first priority is to avoid waste; otherwise waste should be recycled or used to generate energy. As a third option, if this is not possible, it should be disposed of safely. Evonik uses this principle to implement the five-step waste hierarchy defined by EU legislation. As a specialty chemicals company, we are involved in research and development work on mechanical and chemical recycling (see "Value chain and products" p. 33).

Between 2021 and 2030, we aim to reduce specific production waste relative to production volume by 10 percent. We want to achieve this by implementing a wide range of measures at our production sites. These measures were identified, for example, in the EAGER project. In addition, we are continuing our work on a waste management system.

Continuous optimization of production processes contributes to avoiding and minimizing waste. That includes in-plant reprocessing of substance streams and the use of highly specialized catalysts to minimize side reactions. Where waste is unavoidable, the focus is on mechanical or thermal reprocessing. At our sites, various types of recyclable waste, such as glass, paper, and wood, are collected separately and sent to external recycling firms. We regularly monitor these firms through audits to review their suitability in conformance with statutory provisions.

We also use the benefits of integrated production sites and systems for systematic waste management. By-products of a production process are used as raw materials in other production plants. For example, at the integrated C4 production facilities at

Waste management[a,b] 306-4, 306-5 T11

	2022	2023	2022	2023
in thousand metric tons	internal	internal	external	external
Incineration with recycling of heat energy	16	10	25	27
Disposal by incineration	43	43	32	15
Recycling (including composting)	52	34	71	62
Landfill	2	0	55	54
Chemical/physical/biological treatment	9	9	19	17
Other reprocessing methods	2	4	75	44
Other disposal methods	1	1	25	29
Total	**125**	**100**	**302**	**248**

[a] Differences between the data and totals are due to rounding. | [b] Only includes waste streams in the gate-to-gate process.

Waste [a, b] 306-1, 306-2, 306-3, 306-4 T12

in thousand metric tons	2021 internal	2022 internal	**2023 internal**	2021 external	2022 external	**2023 external**	2021 internal and external	2022 internal and external	**2023 internal and external**
Hazardous production waste, reprocessed	69	65	44	64	62	55	133	127	99
Hazardous production waste, disposal	68	45	45	36	50	36	104	95	81
Non-hazardous production waste, reprocessed	4	5	4	45	49	51	49	54	55
Non-hazardous production waste, disposal	13	10	8	43	49	45	55	59	53
Total production waste	**153**	**125**	**100**	**188**	**211**	**187**	**342**	**335**	**287**
Production in thousand metric tons							**9,540**	**8,380**	**7,503**
Specific production waste in metric tons per metric ton production							**0.036**	**0.040**	**0.038**
Development of specific production waste relative to the reference base 2021 in %							**0**	**12**	**7**
Hazardous building and demolition rubble, reprocessed	0	0	0	1	1	1	1	1	1
Hazardous building and demolition rubble, disposal	1	1	0	38	7	8	39	7	8
Non-hazardous building and demolition rubble, reprocessed	0	0	0	39	59	27	39	59	27
Non-hazardous building and demolition rubble, disposal	0	0	0	31	25	26	31	25	26
Subtotal building and demolition rubble	**1**	**1**	**0**	**109**	**92**	**61**	**109**	**92**	**61**
Total	**154**	**125**	**100**	**297**	**302**	**248**	**451**	**427**	**348**

[a] Differences between the data and totals are due to rounding. | [b] Only includes waste streams in the gate-to-gate process.

our site in Marl (Germany), we produce butadiene, butene-1, MTBE (methyl-tert-butylether), isononanol, and plasticizers. Integrated management means that waste products can be used in nearby plants. At Marl Chemical Park, liquid organic residues are used as a substitute for heating oil in the gas synthesis plant at this site, and waste sulfuric acid is recycled in the sulfuric acid plant.

Alongside reprocessing methods, waste with a high calorific value ("substitute fuel") is used to produce energy. This reduces the use of primary fossil fuels. We use some of the exhaust gases from production plants as substitute fuels. Heat from the substitute fuels and incineration gases is used to generate steam.

In our analysis of waste management/circular economy, we distinguish between waste processed on-site and waste transferred off-site. Waste transferred off-site physically leaves our reporting boundaries as "genuine" waste. By contrast, waste processed on-site is recorded as waste, but its environmental impact is generally only registered for the by-products of the various treatment steps, for example, as CO_2 from incineration T11 p. 60.

In 2023, total waste decreased by 19 percent year-on-year to 348,000 metric tons. The reduction in production waste was mainly attributable to the reduction in production in 2023, while the reduction in building and demolition rubble was due to a reduction in construction activity. Construction activity depends on specific measures and may vary considerably from year to year. The percentage of waste reprocessed comprises recycled substances, incineration with recycling of heat energy, and other disposal methods. The reprocessing rate decreased to 52 percent in 2023 (2022: 56 percent).

Biodiversity

Strategy and management

Biodiversity is one of Evonik's 15 material topics. We are aware that our business operations involve both opportunities and risks with regard to biodiversity. These include, for example, the loss or protection of biodiversity on land and in the oceans, including microbial organisms. It is important to avoid supply chain disruption and production stoppages caused by reduced biodiversity and damaged ecosystems.

The starting points for our examination of biodiversity are conventional environmental topics such as emissions into water and the air and responsible water and waste management, which we report on regularly. In addition, the following aspects of biodiversity are addressed in the sustainability analysis of our business: water, eutrophication, acidification, land use, use of renewable raw materials, emissions of critical and persistent chemicals, and microplastics. Our contributions to maintaining diversity are bundled in our Sustainability Focus Area safeguard ecosystems p.140.

In the reporting period, we were involved in various biodiversity workstreams at the German chemical industry association (VCI) and the federation of German industries (BDI) and also took part in various consultation procedures. Moreover, we continued our discussions with the European Commission on the EU biodiversity strategy for 2030 with a focus on the proposed EU soil legislation.

In 2023, we also set up internal expert groups to examine relevant aspects of biodiversity. We started to analyze new reporting guidelines and methods and to define and calculate additional biodiversity indicators. In addition, we are preparing for the new EU reporting requirements of the CSRD, ESRS E4 Biodiversity and ecosystems. We follow the activities of biodiversity initiatives such as the Task Force on Nature-related Financial Disclosures (TNFD), Science Based Targets for Nature (SBTN), and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

For biodiversity analyses, we still use a geoinformation system based on the data of the IBAT Alliance[1]. On this basis, we annually examine the potential impact of our worldwide sites on areas of special significance for biodiversity. This focuses on all sites within one kilometer of conservation areas or key biodiversity areas. Key biodiversity areas are areas with land, freshwater, and marine ecosystems that play a key role in protecting global biodiversity. Areas are classified as global key biodiversity areas if they meet one or more of eleven criteria, which are subdivided into the following five categories: threatened biodiversity, geographically restricted biodiversity, ecological integrity, biological processes, and biological irreplaceability. The data on key biodiversity areas are also made available by the IBAT alliance and are linked to the data on Evonik sites in our geoinformation system GIS-Sus. Overall, 37 percent of our production sites are located within one kilometer of conservation areas or key biodiversity areas. The table showing sites adjacent to conservation areas in 2023 includes Natura 2000 areas.

Ecosystem services and direct drivers of biodiversity loss based on IPBES [2, 3]

Biodiversity and ecosystems are natural capital and form the basis for processes that are vital for life. They provide what are known as ecosystem services, which can be divided into four categories:

- Provisioning services (e.g., wood, water, clean air)
- Regulating services (e.g., climate regulation, pollutant decomposition, water purification)
- Supporting services (e.g., nitrogen and carbon cycles, water cycle, soil formation)
- Cultural services (e.g., therapeutic, recreational, spiritual fulfillment)

Communities and economic systems are supported by these ecoservices. The IPBES reports that biodiversity and ecosystem services are decreasing as a result of anthropogenic influences. According to the IPBES, the direct drivers of the reduction in biodiversity and ecosystems are:

- Land use/seascape change
- Resource use
- Climate change
- Pollution
- Invasive alien species

[1] The IBAT Alliance comprises the following four non-governmental organizations: (1) Bird Life International, (2) Conservation International, (3) International Union for Conservation of Nature (ICUN), (4) United Nations Environment Programme World Monitoring Centre (UNEP-WCMC).
[2] IPBES = Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.
[3] Source: IPBES 2019; Global Assessment Report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Diaz, H. T. Ngo **ipbes.net/global-assessment**

Evonik production sites adjacent to conservation areas 2023 304-1 T13

Production site	Country	Area in km²	IUCN[a] categories	Ramsar[b] area	Natura 2000[c] area
Lafayette	USA	7.004	V		
Marl	Germany	6.529	IV, V		×
Morrisburg	Canada	1.132	Ia		
Antwerp	Belgium	1.083	IV	×	×
Hanau-Wolfgang	Germany	0.779	IV, V		×
Rheinfelden	Germany	0.554	V		
Wesseling	Germany	0.331	IV, V		×
Herne	Germany	0.261	IV, V		
Krefeld	Germany	0.237	IV, V		×
Greensboro	USA	0.235	V		

[a] IUCN = International Union for Conservation of Nature.

[b] Ramsar Convention = convention on wetlands, especially as habitats for waterfowl.

[c] Natura 2000 = an EU-wide network of protected areas to protect endangered or typical species and habitats.

Compared with 2022, the list of the ten largest production sites adjacent to conservation areas no longer includes Lülsdorf (Germany) because this site was sold to International Chemical Investors Group (ICIG), effective June 30, 2023. Instead, the list now contains Greensboro (North Carolina, USA). Moreover, the area of some sites deviates slightly from the data published in 2022.

Overall, there are 34 production sites adjacent to conservation areas. The total area of all production sites adjacent to conservation areas is 19.8 km².

Evonik production sites adjacent to key biodiversity areas 2023 304-1 T14

Production site	Country	Area in km²	Criterion
Antwerp	Belgium	1.083	Migratory birds, other
Rheinfelden	Germany	0.554	Other
Delfzijl	Netherlands	0.105	Endangered species, migratory birds, other
Tonawanda	USA	0.087	Migratory birds
Qingdao	China	0.040	Species threatened with extinction, critically endangered, and endangered species
Taoyuan City	Taiwan	0.035	Endangered species, migratory birds
Ami-Machi	Japan	0.034	Endangered species
Rheinmünster	Germany	0.026	Endangered species, migratory birds, other
Umbogintwini	South Africa	0.020	Species threatened with extinction, critically endangered, endangered, and endemic species
Lauterbourg	France	0.018	Endangered species, migratory birds, other

T14 shows our ten biggest production sites adjacent to key biodiversity areas. Compared with 2022, we have added the site in Rheinmünster (Germany). There have also been slight changes in the area of the sites in Rheinfelden (Germany) and Tonawanda (New York, USA) compared with 2022.

We have a total of 11 sites adjacent to key biodiversity areas. The total area of all production sites adjacent to key biodiversity areas is 2.0 km².

In 2023, we embarked on a more detailed examination of the direct drivers of biodiversity loss defined by IPBES. The main drivers of relevance for Evonik are climate change, pollution, direct use of resources, and land-use change. We report extensively on climate change and pollution in CDP Climate Change. In the area of direct use of resources, we are currently focusing on our water consumption, which we report in CDP Water Security. We address aspects of changes in land use in CDP Forests in connection with palm oil, palm kernel oil, and their derivatives p. 168. In the selection of raw materials, we apply internationally recommended certification standards for palm oil and plan to use only deforestation-free palm derivatives (see "Value chain and products" p. 37).

In the future, we want to analyze the bio-based raw materials we procure. The focus here will be on land use and changes in land use with regard to purchased renewable raw materials and the related water consumption for irrigation. This is an important lever for Evonik's biodiversity footprint. Invasive alien species are not currently classified as material for Evonik.

Progress with these aspects is altering our analysis of the biodiversity of our sites. In the future, we will be giving greater priority to a holistic perspective. Alongside the drivers of biodiversity loss, we intend to review risk assessments and our dependence on ecosystem services. In the reporting period, we started to identify and evaluate nature-related risks and opportunities, using the LEAP[1] method developed by TNFD. That will help us include biodiversity even better in the sustainability analysis of our business p. 20.

[1] LEAP = Locate, Evaluate, Assess, Prepare.

In addition to compiling data on conservation areas, in 2023, for the first time, we used the WWF Biodiversity Risk Filter and the WWF Water Risk Filter to assess the risks of all sites p. 57. This shows that, at present, Evonik has five production sites in regions with high physical risks. The biggest physical risks at these sites are environmental pollution, tropical cyclones, and landslides. None of our sites is located in an area classified as having generally high reputational risks, but particularly critical media reports represent a high or very high risk at most sites. At sites where the anticipated risks are high and that are also close to conservation or key biodiversity areas, we want to examine the direct drivers of biodiversity loss in more detail in the future. This could be done through interviews and workshops at the relevant sites.

In addition, we are working to compile and visualize further biodiversity indicators. To this end, a group-wide biodiversity dashboard is currently being developed so that the most affected sites can be identified more easily in the future and appropriate action can be defined.

When upgrading the railroad bridge over the Silvert stream in Marl, we considered all ecological aspects and discussed them with the nature protection organization NABU, local residents, and the local authorities. The project includes rewilding the stream in this area and incorporating a hibernation bat box into the bridge.«

Thomas Kruck | Project Manager, Construction Engineering, Germany

Biodiversity

Our sites are engaged in various initiatives to protect biodiversity. For example, the Evonik site in Antwerp (Belgium) is committed to participating in the Voka[1] Charter for Sustainable Entrepreneurship . This goes hand in hand with the implementation of the 17 SDGs. We have already implemented the first points, including renesting protected barn swallows and collecting litter, both on the site and beyond. At our site in Marl (Germany), we are involved in a project to rewild the Silvert stream.

Evonik's products and solutions[2]

Declining biodiversity has a negative effect on Evonik's business activities. At the same time, our business activities can have a negative effect on biodiversity. However, Evonik's products and solutions also play a part in maintaining biodiversity and help protect habitats.

Peracetic acid from Evonik is an effective alternative to established biocides for disinfecting wastewater. Before the treated wastewater is discharged into the environment, it undergoes a disinfection process to eliminate pathogenic bacteria. This prevents the bacteria from getting into waterways used by people for recreational purposes or fishing. One big advantage of peracetic acid compared with chlorinated disinfectants is that it decomposes, and no or only very few toxic by-products are released.

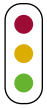
Evonik's Health Care business line markets products that can be used as alternatives to animal-derived substances in pharmaceutical applications and therefore make a positive contribution to circularity and biodiversity. One example is PhytoChol®, a plant-based cholesterol, which is an essential component in the production of lipid nanoparticles, a key technology for drug delivery. Another example is PhytoSquene®, a squalene based on amaranth oil. We therefore offer an alternative to traditional production from shark liver oil, which makes a contribution to preserving the biodiversity because many species of shark are currently endangered.

[1] Voka = A Flemish network of companies in Belgium.
[2] Information on CO_2e avoided by the use of Evonik products can be found in "Strategy and growth" p. 24.

Our targets

Below is an overview of the targets set for the environment area of action.

Target attainment in 2023	Targets for 2024 and beyond
Reduce absolute scope 1 and scope 2 emissions by 25 percent between 2021 and 2030 (status: –15 percent)	Reduce absolute scope 1 and scope 2 emissions by 25 percent between 2021 and 2030
Reduce absolute scope 3 emissions[1] by 11 percent[2] between 2021 and 2030 (status: – 17 percent)	Reduce absolute scope 3 emissions[1] by 11 percent[2] between 2021 and 2030
Reduce both absolute and specific energy consumption by 5 percent between 2020 and 2025 (status: –8 percent absolute; +10 percent specific)	Reduce both absolute and specific energy consumption by 5 percent between 2020 and 2025
Switch purchased electricity to 100 percent green electricity by 2030 (status: +35 percent)	Switch purchased electricity to 100 percent green electricity by 2030
Reduce specific freshwater intake by 3 percent relative to production volume between 2021 and 2030 (status: +12 percent)	Reduce specific freshwater intake by 3 percent relative to production volume between 2021 and 2030
Reduce the specific volume of production waste by 10 percent relative to production volume between 2021 and 2030 (status: +7 percent)	Reduce the specific volume of production waste by 10 percent relative to production volume between 2021 and 2030



Target not achieved
Target partially achieved or target horizon extends beyond 2023
Target achieved

[1] Scope 3 emissions comprise all upstream categories and the category "Downstream transportation and distribution" as defined in our SBTi target.
[2] Exact target: 11.07 percent.

IMPLEMENT!

—Our focus projects*

2023

EnBW HeDreiht offshore wind farm

69

H_2annibal project

73

Future Sustainable Car Materials

77

Sustainable skincare products

81

* This special section is outside the scope of the auditor's limited assurance engagement.

Introduction

Driving forward the transformation of industry and society means actively shaping fundamental changes. Evonik wants to make a contribution to a future that is worth living—a future that uses resources efficiently and is innovative, sustainable, and profitable. We can only achieve that by working together with everyone in the value chain—our employees, customers, and suppliers.

Our activities are focused on those aspects that are of material importance for us and our direct stakeholders. We take into account both how Evonik impacts the environment and society and how the environment and society impact us. In our materiality analysis, we evaluated and weighted these impacts. In this way, we identified 15 material topics, three of which are particularly relevant for Evonik: **green energy, portfolio transformation,** and **circular economy.**

Transformation may be triggered by innovations or by changes in society's needs and the environment. We therefore review our material topics every year and compare them with current trends and developments. That helps us keep an eye on the implementation of our sustainable corporate strategy for the transformation to **Next Generation Evonik** and address the changes as we move forward.

In this special section of our sustainability report 2023, we have selected four examples that illustrate how we help make our world more sustainable in collaboration with our partners. The focus is our three most important material topics. Trustful collaboration and close partnerships pave the way for their implementation.

Green energy is the basis for the energy transition. Together with *Siemens Energy,* we are researching and testing *innovative hydrogen technology in an industrial environment* at our site in Herne (Germany). The goal is to use green electricity to generate green hydrogen, which is used in the production of a key precursor for rotor blades for wind turbines. Our collaboration with *EnBW* shows how we *source green electricity from wind farms* for our sites and, at the same time, make a contribution to more widespread use of renewable energies.

In the *Future Sustainable Car Materials* project, we are working in a consortium with *BMW*. Our joint aim is to close the plastics cycle and make a contribution to a **circular economy.** Evonik and its customers know that **portfolio transformation** can only be achieved by working together as partners. A good example is *Beiersdorf* and its shift to more *sustainable skincare products.* We show how we work together to tackle challenges and develop viable solutions.

We partner with our customers to go beyond what is considered possible today. Together, we work on new solutions for the most important questions for our shared future.

WE GO BEYOND.

Introduction

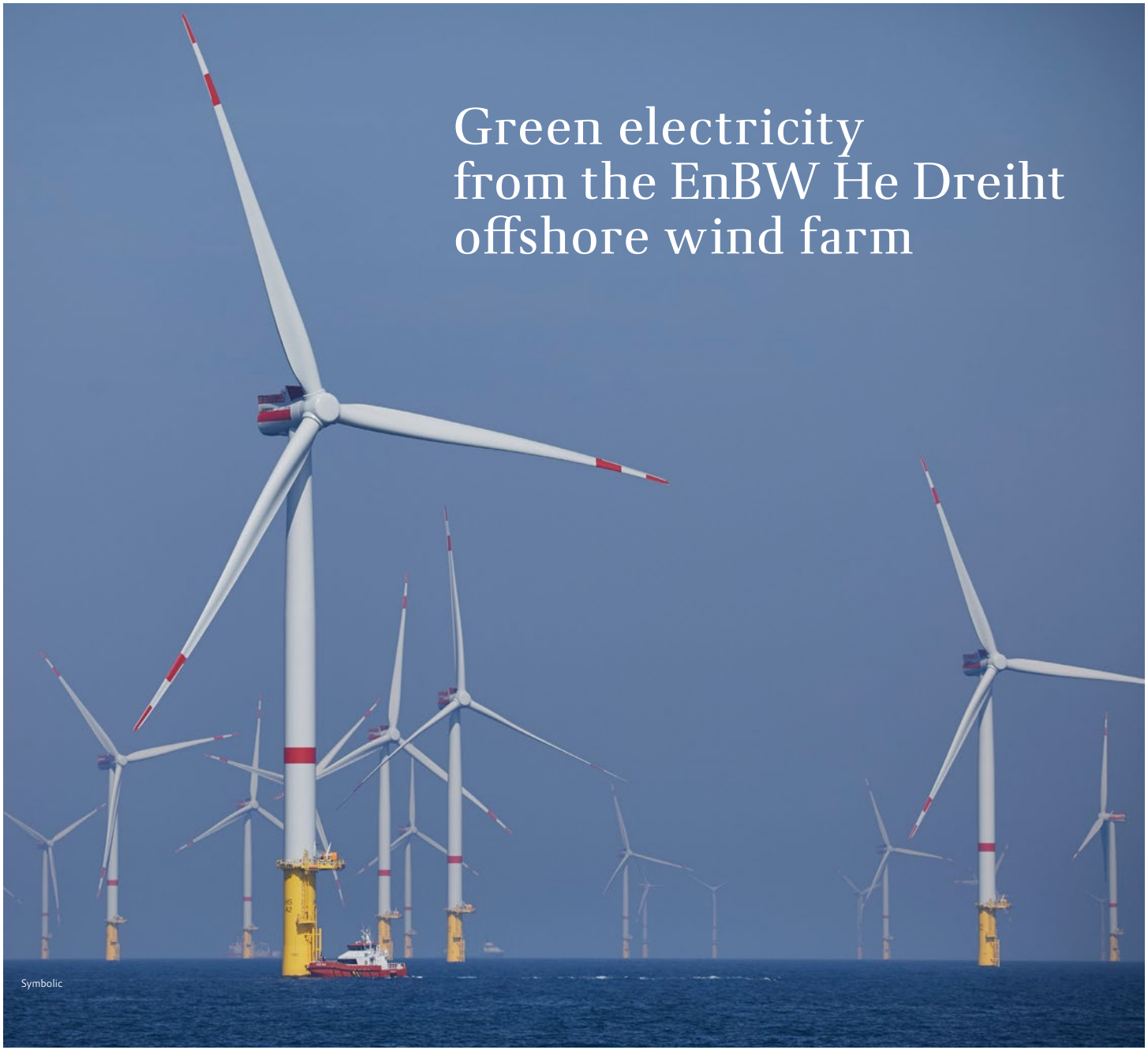
Green energy

Dr. David Gohsen (Evonik) and Dr. Thomas Schrey (EnBW) at EnBW's offshore office.

Wednesday, November 15, 2023, 7.30 a.m.
Chilehaus, Hamburg

The sun has not risen yet, and Chilehaus, a UNESCO World Heritage building, shines out magnificently in the dark.

Dr. Thomas Schrey (PPA Originator at EnBW) and Dr. David Gohsen (Head of Portfolio Management Power at Evonik) have scheduled an early-morning meeting in the offshore wind office of energy company EnBW (Energie Baden-Württemberg AG) to discuss the new EnBW He Dreiht offshore wind farm and Evonik's power purchase agreement (PPA) for green electricity.



View of the prow of the Chilehaus.

Discussing the location of the new EnBW He Dreiht offshore wind farm.

David Gohsen: Hello Thomas, nice to see you. Many thanks for agreeing to today's meeting in your offshore wind office in Hamburg to talk about our long-term purchase agreement for green electricity.

Thomas Schrey: Hello David, I'm glad to welcome you to our office here in the Chilehaus. The shape of this building is reminiscent of a ship. It's almost a hundred years old and is a UNESCO World Heritage Site.

David: Originally, it was a symbol of economic upswing. In much the same way, Evonik wants to play a proactive role in shaping and driving forward the energy transition. One particular goal is that, by 2030, all the electricity we source externally should be green. Green energy and the associated reduction in CO_2 are central to our sustainable corporate strategy. From 2026, we will be sourcing 150 MW of electric power from the EnBW He Dreiht offshore wind farm. That will meet more than a third of Evonik's total electricity demand in Europe. *Thomas, perhaps you can give us some more details of the project and the present status.*

Thomas: Nomen est omen: He Dreiht is a dialect term for "It Spins". That's a really apposite description of EnBW's third wind farm! It is being built at a site about 90 kilometers north-west of the island of Borkum and 110 kilometers west of Helgoland. It will have 64 wind turbines in total, with installed capacity of 960 MW and will start to feed electricity into the grid at the end of 2025. As one of the first non-subsidized offshore wind farms, it will almost double EnBW's offshore portfolio, which generates an output of 976 MW at present.

He Dreiht moves into a completely new dimension compared with our other North Sea wind farms, Hohe See and Albatros, which are already operating. It is also the first commercial project to use the Vestas V236-15 turbines, which have a nominal power of 15 MW each.

So EnBW is continuing its pioneering role in the offshore sector. Moreover, with total installed capacity of 960 MW, EnBW He Dreiht is currently one of the largest projects for Europe's energy transition. Theoretically, it could supply renewable electricity to 1.1 million households.

With a hub height of 142 meters and a rotor diameter of 236 meters, one rotation covers an area of 43,742 square meters—equivalent to six soccer pitches. The grid operator TenneT TSO will connect the wind farm to the grid via an offshore transformer station and two high-voltage direct current cables. The total cable length will be 230 km, with 120 km offshore and 110 km onshore.

The EnBW He Dreiht project is financed exclusively by the private sector and will be one of Germany's first non-subsidized wind farms.«

Dr. Thomas Schrey (EnBW)

The Video. The Podcast.

Manufacture of the transition pieces began early in 2023. Work on the monopiles and the cabling has also commenced, and production of the wind turbines started recently as well. From the permitting, financing, and production perspectives, the project is right on schedule. *David, could you explain why you decided to take part in our offshore wind tender?*

David: That's a great question. The advantages of offshore wind energy are clear: Offshore wind turbines benefit from higher and steadier wind speeds. Therefore, they can generate about twice as much electricity as comparable onshore installations.

That makes them very reliable and ensures even energy generation, so they are an attractive basis for generating power from renewables.

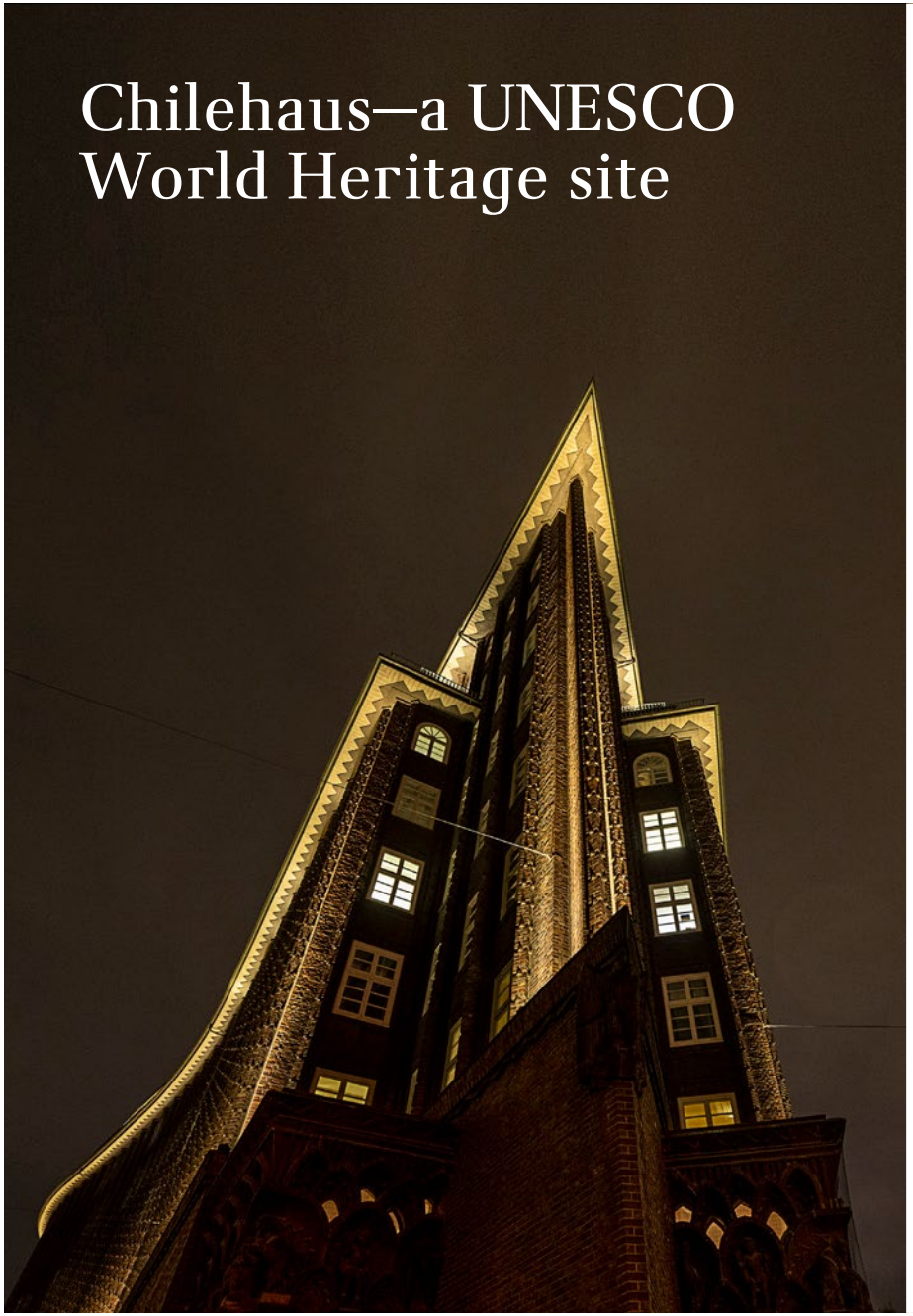
Through our commitment, we want to encourage the installation of further renewable energy assets and drive forward the energy transition. Our agreement secured the financing, so it was possible to start realizing the wind farm. That additionality factor was an important aspect of the EnBW He Dreiht project and our decision to take part in the tender. *Thomas, could you explain in detail what these PPAs are and what function they have for Evonik?*

Thomas: Of course. Power purchase agreements—or PPAs for short—are long-term supply contracts between suppliers and, generally, large industrial users. Like our joint PPAs, they often run for more than 15 years. The industrial customers source physically green electricity directly from renewable resources via these installations, often on fixed, predefined terms.

Perhaps I should say that PPAs are a central element in the energy transition: they help guarantee reliable financing of major projects because they give the operators calculable revenues of cash inflows. The EnBW He Dreiht wind farm is a good example.

The electricity supply agreements we signed with you at a very early stage in the project were the key basis for obtaining the approval of EnBW's supervisory board for the final investment decisionin the wind park in March 2023. As a result, this purely privately financed project is making progress and EnBW He Dreiht will be one of Germany's first non-subsidized wind farms.

Chilehaus—a UNESCO World Heritage site



The Kontorhaus and warehouse districts and the Chilehaus in Hamburg (Germany) were awarded UNESCO World Heritage status on July 5, 2015.

The Chilehaus is an office building built between 1922 and 1924 in Hamburg's trading district. The architect, Fritz Höger, was a pioneer of brick expressionism in the 1920s. The Chilehaus covers an area of 5,950 m^2 and was one of the first high-rise buildings in Hamburg with up to ten storeys, a gross surface area of 36,000 m^2, and 2,800 windows. With its eastern tip resembling the prow of a ship, it is an icon of expressionist architecture.

Incidentally, this striking tip is the sharpest angle of any facade in Europe.

As well as its unique architecture, the building is a symbol of Hamburg's economic upswing. Over the years, it has become a tourist attraction. It is particularly worthwhile viewing the building's charming interior features: the linoleum flooring, which is subject to a conservation order, the paneled mahogany doors in the stairwells with their hand-wrought brass handles, and the elaborate decor. For the construction of this building, the merchant Henry Brarens Sloman purchased 4.8 million bricks in 1922.

H_2annibal project*—Water electrolysis for Herne

Members of the Siemens Energy and Evonik joint project group (from left: Axel von Levetzow, Dr. Rainer Stahl, Eric Klein, and Lutz Komorowski).

Friday, November 17, 2023, 8 a.m.: Siemens Energy Gigawatt Factory in Berlin (Germany)

This morning, two representatives of Evonik, Dr. Rainer Stahl (Manager of the Herne site) and Lutz Komorowski (Head of Electrical and Process Control Technology in Herne), are meeting with Eric Klein (European Sales Director, Hydrogen) and Axel von Levetzow (Production Manager Gigawatt Factory) from Siemens Energy for a tour of Siemens Energy's new Gigawatt Factory, where stacks for proton exchange membrane (PEM) electrolyzers are manufactured. The key components of the planned electrolyzer for the Herne site will also be produced here.

**The H_2annibal project: a pilot electrolyzer to produce hydrogen for IPDA production at the Herne/Hannibal mine site is funded by the German Federal Ministry of Education and Research. Funding reference: 03HY131B.*

Green energy

Green hydrogen, in other words, hydrogen produced with the aid of renewable energy, is a key element in the transition from fossil fuels and feedstocks to renewable resources and an important step forward in the Herne Green Deal.«
Dr. Rainer Stahl

Thanks to our highly automated series production of PEM stacks, we are well-positioned to meet a significant rise in demand for equipment to produce hydrogen. That is an important basis for the defossilization of industry.«
Eric Klein

Wind energy for green hydrogen and green hydrogen for wind energy

Evonik is investing in a pilot electrolyzer at its site in Herne (Germany) to produce green hydrogen as a starting product for isophorone diamine (IPDA), a key raw material for the rotor blades for wind turbines. In the electrolysis process, water is split into green hydrogen and green oxygen with the aid of green electricity.
Evonik plans to invest a total of €700 million in production processes by 2030 as part of its Next Generation Technologies drive. Our goal is to reduce our carbon footprint (scope 1 and 2 emissions) by 25 percent. The H_2annibal project is one element in this. Incidentally, it is named after one of the shafts at a former coal mine.

The project started at the end of 2022 and runs until mid-2025. The aim is to install industrial-scale water electrolysis technology at Evonik's site in Herne and test how it stands up to industrial operation. Installation by the project partners—Siemens Energy and Evonik—is in full swing. When it is completed, the site will have a state-of-the-art electrolyzer (advanced technology based on the Silyzer 300) with the capacity to produce 13.5 million m^3 of green hydrogen a year. It will be powered by green electricity, for example, from offshore wind farms. It will be able to meet about 45 percent of the hydrogen required by this site each year and 100 percent of its oxygen requirements. As well as avoiding 12,500 metric tons CO_2 a year, local production will make operation of the facilities at the site more reliable. At present, gray hydrogen (see box "The colors of hydrogen") is delivered to the site by pipeline. A single pipeline is used to supply the entire site, which is also a risk for production availability. Therefore, beside the impact on the carbon footprint of production in Herne, the decentralized production of hydrogen directly at the production site offers the opportunity to avoid any shutdowns in the event of pipeline maintenance or defects. In addition, the decentralized production offers the opportunity to free up capacity of the existing pipeline networks and therefore offer capacities for new hydrogen applications. The new Siemens Energy PEM electrolyzer at the site will have rated power demand of 8 MW. If the project is successful, a second electrolyzer could be installed in the same building in order to raise the supply of green hydrogen to 100 percent of the site's requirement.

The industrial significance of hydrogen

Steel, chemical, petrochemical feedstocks and the production of ammonia are important industries. Mobility—aviation, shipping, and the transportation of heavy goods—is another key sector where hydrogen could play an important role, along with synthetic fuels. In the energy sector, hydrogen will be used both as an energy storage medium for exports and long-distance transportation and in re-electrification in hydrogen-capable gas turbines.

To replace fossil fuels, sufficient quantities of green hydrogen need to be available at competitive prices. That requires massive expansion of renewable energies, the construction of highly automated factories to produce gigawatt-scale industrial electrolyzers, and pipelines and large-scale infrastructure for the storage and transport of hydrogen. One significant factor in this is how the price of fossil fuels develops, especially in light of carbon pricing.

The PEM electrolyzer technology being installed in Herne has enormous potential for use in the chemical industry: It can respond flexibly to fluctuations in power supply and the demand for hydrogen and also enables the use of high-purity oxygen. Moreover, the floor space required for installations is low.

Why is Herne an ideal site for the use of green hydrogen? Green hydrogen is a key element in defossilization. It can be used as a storage media and a starting product for other applications, for example, for "green chemistry". Herne could become the first chemical site where production without any fossil-based resources is possible. Evonik calls this the "Herne Green Deal".

Among other things, the Herne site produces isophorone, which is then processed into VESTANAT® IPDA eCO, a crosslinker used in the manufacture of rotor blades for wind turbines. Simple commodity chemicals such as hydrogen, ammonia, methane (natural gas), acetone, and oxygen are required to produce this product. Those are all compounds that can already be procured from sustainable production or, even better, produced on-site.

Transforming Herne into a green site in this way is possible, but it takes time, and we need colleagues and partners who are prepared to think out of the box. That requires a real team effort. At the same time, we must never lose sight of the cost-efficiency of the project.«
Lutz Komorowski

Without green molecules there would be no energy transition. By producing electrolyzers on a gigawatt scale, we're creating the technological basis for the smallest molecule to be a huge success story.«
Axel von Levetzow

Siemens Energy Gigawatt Factory for electroylzers

In November 2023, Siemens Energy and Air Liquide opened a new Gigawatt Factory for electroylzers in Berlin. This 2,000 m^2 manufacturing facility produces stacks, which are the key components of electrolyzers. The stacks are based on proton-exchange membrane (PEM) technology. The new factory allows highly automated industrial-scale manufacturing of PEM electrolyzers, enabling a rapid ramp-up of production for gigawatt-scale production. The stacks produced in Berlin are assembled into ready-to-use electrolyzers at the Siemens Energy facility in Mühlheim an der Ruhr (Germany) or by partners close to the project locations.

Annual production capacity was initially 1 gigawatt and is scheduled to increase to 3 gigawatts in 2025. An installed electrolyzer with capacity of 3 gigawatts powered by renewable energy could produce an average of 300,000 metric tons of green hydrogen a year. If the green hydrogen were used as a substitute for fossil fuels, it would be possible to avoid the CO_2 emissions of a town the size of Aachen (Germany), which has 260,000 inhabitants.

The colors of hydrogen

Green hydrogen
Green hydrogen is produced by electrolysis of water with electricity sourced entirely from renewables. Production is completely CO_2-free.

Gray hydrogen
Gray hydrogen is produced from fossil fuels, and the CO_2 released is discharged unused into the atmosphere.

Blue hydrogen
Blue hydrogen is gray hydrogen that uses carbon capture and storage (CCS) to capture the CO_2 during production.

Turquoise hydrogen
Turquoise hydrogen is hydrogen produced via thermal splitting of methane. Solid carbon is generated instead of CO_2. This process may be carbon-neutral if the heat supplied for the process comes from renewable resources and the carbon released is permanently captured.

Green hydrogen and its derivatives can make renewable energy available to industry and the transportation sector for defossilization of all end-consumer sectors. As a first step, the gray hydrogen currently used is being replaced by green hydrogen.

Robot-assisted high-tech production of electrolyzer stacks.

Visual check on a newly produced PEM membrane.

View of the fully automated stack production for PEM electrolyzers.

The Podcast.

The Video.

Future Sustainable Car Materials (FSCM)– Making autos more sustainable

Martin Derks: *»We work continuously to reduce the carbon footprint of our cars. The materials we use play a major role.«*

Dr. Patrick Glöckner: *»Collaboration and teamwork are vital to make circularity a success. By building up ecosystems, we can develop a functioning circular economy along our value chains.«*

Circular Economy

Thursday, November 30, 2023, 8 a.m.: BMW Research and Innovation Center, Munich (Germany)

It is snowing heavily as Martin Derks (Head of the FSCM consortium, BMW Group), Martin Schneebauer (Project Manager Plastics, BMW Group), Dr. Patrick Glöckner (Head of the Circular Economy Program at Evonik), and Kathrin Lehmann (Head of Applied Plastics Additives at Evonik) meet at the FIZ, the BMW Research and Innovation Center in Munich (Germany). Today's topic is Future Sustainable Car Materials. This project consortium is led by BMW with Evonik as a key partner in the area of plastics, and receives funding from the Federal Ministry of Economic Affairs and Climate Action.

The project team inspecting plastic components made from recycled materials and taking a close look at samples of possible applications in cars.

Martin Derks: Patrick, thank you for coming along to our Research and Innovation Center today. We've known each other for some years and set up the Future Sustainable Car Materials (FSCM) project together. This project is about the development of key materials in the automotive value chain. One focus of the project is metals. Here we're improving the efficiency of the direct recycling of rejects, increasing the secondary aluminum content, and developing high-strength steel grades to reduce weight and increase material efficiency. At the same time, we're looking into lower CO_2 production routes for the production of steel and aluminum. In plastics, we're concentrating on increasing the content of secondary raw materials and integrating mechanical recyclates into interior and exterior applications. We're also working on new concepts to replace paint and exploring the use of bio-based plastics to reduce CO_2 emissions even further. Today, we want to talk about the challenges and progress in the area of plastics. What are you working on at the moment?

Patrick Glöckner: I'm specifically looking at the European Union's Circular Economy Action Plan, which is a central element in the European Green Deal. One aspect that affects both of us is the end-of-life vehicles regulation, which is designed to push the automotive industry towards a circular economy. What makes it particularly interesting and exciting is that we began working together on this topic long before the EU started to discuss it intensely. It was back in 2020 that we first talked about a project that could set new standards for plastics recycling in the automotive industry.

Martin: Looking back, I'm really happy we did start our collaboration in 2020. We welcome the fact that politicians are setting guidelines and frameworks. Circularity is a topic that's important for society; it affects us all. We recognized early the challenges of a circular economy for plastics. That's why we initiated the FSCM project, a cross-industry alliance to tackle the challenges together. However, that can only work if we all get together around the same table.

Patrick: Precisely. Together, we ensure that the project covers the entire value chain. Large corporations like BMW and Evonik are involved, but to close the loop, we also have partners from the SME sector. Now we understand the challenges facing some players and the hurdles for the others. BMW is a premium partner, and we discuss the hurdles openly and constructively so that we can find solutions.

Martin: Patrick, that's exactly how I see it, too. Our customers expect us to deliver a sustainable, premium product. We don't see anything incompatible in that. Our cars already contain a secondary raw material content of up to 30 percent. Closed loop post-consumer recycling in the automotive industry requires everyone involved to work together closely. Coated plastics are a good example. Cars contain a lot of coated plastics. The challenge for the future is sorting and processing these materials so that they can be returned to the closed loop with the highest possible proportion of recycled materials.

Patrick: That involves some incompatible aspects that need to be tackled. On the one hand: high performance. For example, the paintwork must not peel off during use. On the other hand, stripping the paintwork from plastic components after use needs to be quick and complete so that it is economically viable. That's exactly where specialties offer solutions, and that's where Evonik comes in. Our specialty additives facilitate cleaning by recyclers and can enable high-quality plastic blends. Therefore, the companies involved in this project are a perfect fit.

Martin: I'm convinced that many of the challenges are solvable. Take paintwork for example. It doesn't only look appealing; it also has a protective function. Without it, the polymers would degrade, in other words, they would age faster. Fortunately, there are solutions to overcome the challenges of paint stripping. That enables us to avoid down-cycling plastics and return them to the automotive loop. Targeted research has the goal of ensuring recycled plastics are equivalent so they can be kept in the closed loop. That means that the properties of the recycled materials need to be identical to those of the primary materials. That's what our customers expect from us. At the same time, it's one of the biggest challenges for the plastics industry and confronts us with a massive transformation.

Patrick: In this project, we show how this transformation can be achieved with partners along the value chain.

Martin: There are 19 different partners in the Future Sustainable Car Materials project. We look at the entire value chain, strive to find new solutions for sustainable materials, and examine the possibility of using biopolymers. That includes considering how components can be designed in the future to make recycling more economical. Examples are the use of monomaterials and developing new logistics chains for waste streams. The use of different material qualities also plays a part. The chemical industry and Evonik in particular can play an important role to ensuring that recycled polymers meet the same quality standards as new materials. By that I mean mechanical properties, appearance, color, odor, and minimizing the carbon footprint of the product.

Patrick: Working together at all stages in the value chain is exactly what the circular economy is all about. The FSCM project offers us a big chance to benefit from the different skill sets of the various partners involved. One aspect that we rarely had to consider in the chemical industry in the past was "Where does the material actually come from, and what are its properties?" Now we have to ensure that high volumes of recyclates of varying quality can be used without impairing the performance profile. Those are big challenges. Customers want cars with recycled materials yet make premium demands on their quality and characteristics. The goal of the additives we are developing is to match those requirements.

Martin: One thing which helps us in the FSCM project is digitalization. We're using the Catena-X data ecosystem, which provides the necessary data format for the digital fingerprint of the materials. It's also a platform for collaboration. Evaluating the data supports standardization and will also create value for the companies involved. It will help drive forward the value chain. That can become a real locational advantage for Europe and Germany.

Patrick: As you say, standardization and harmonization are only possible by digitalizing the value chain. Recyclers need to know what plastics are being delivered to them and how they can be recycled most effectively so that the product can be used, for example, as a new fender in a new vehicle.

In the podcast, Kathrin Lehmann (Evonik) and Martin Schneebauer (BMW) talk about the practical challenges of the FSCM project.

Kathrin Lehmann: *»To produce a high-quality recyclate, it's essential that the paint can be stripped completely and efficiently from the old components.«*

Martin Schneebauer: *»One future challenge is separating and processing plastics so they can be re-used in the closed loop, with a high recyclate content.«*

FSCM project

The Video.

The Podcast.

BMW is working to increase the recycled content of cars, especially in interior components.

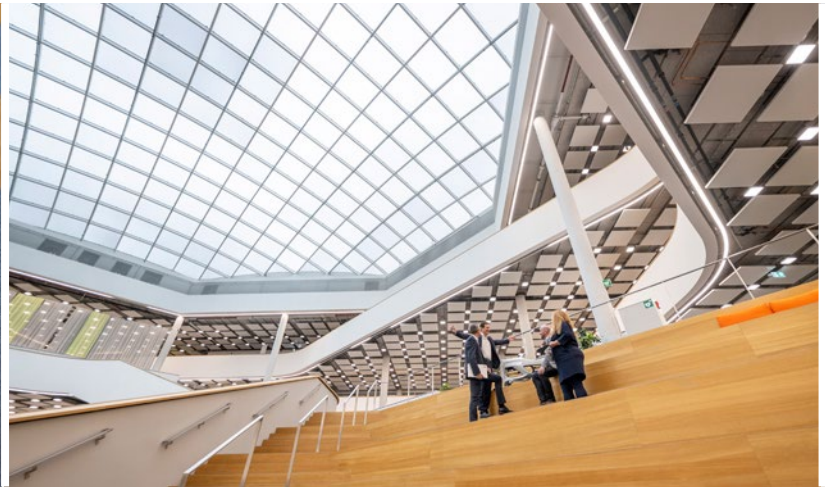
Digitalization
Video

Recycling
Video

Future Sustainable Car Materials

The Future Sustainable Car Materials (FSCM) project led by the BMW Group brings together 19 partners from industry and research to facilitate the transition to circular and low-carbon value chains for plastics and metals in automotive production.

This three-year project, which receives funding from the Federal Ministry for Economic Affairs and Climate Action, focuses on sustainable material concepts for the future.



Portfolio transformation

Friday, December 15, 2023, 8 a.m.:
Beiersdorf Campus, Hamburg (Germany)

Partnering to create more sustainable skincare care products

The Nivea brand store at the Beiersdorf Campus.

Today, Julia Beier, Dr. Ingo Hahn, Julia Niedermeier, Urte Koop, and Dr. Manuela Köhler from Beiersdorf are meeting with Peter Becker, Dr. Achim Friedrich, and Jörg Prante from Evonik at Beiersdorf's research center in Hamburg (Germany). The agenda for today's meeting is portfolio transformation as both companies move towards greater sustainability. In fact, it is one of the topics that they regularly address—together with further participants—at Beiersdorf's Sustainability Campus.

For us at Beiersdorf, sustainability is a key priority of corporate strategy. Our CARE BEYOND SKIN Sustainability Agenda defines our responsibility to our customers, society, and the environment. We are aware that we have a long journey ahead to transform our company and value chain, but we are optimistic that we can achieve our ambitious targets and play a pioneering role in the transformation of the cosmetics industry.«

Urte Koop
(Principal Scientist Sustainability, Beiersdorf)

The long-standing partnership between Beiersdorf and Evonik is based on trust and shared sustainability goals. We have developed a common understanding of sustainable raw materials and have used it to define sustainable product indices (SPIs). That makes us quick and effective when we validate new, more sustainable raw materials. That is an important precondition for transforming Beiersdorf's product portfolio. Our cooperation is helping us to come up with more sustainable solutions so we can achieve our climate target as soon as possible.«

Dr. Ingo Hahn
(Manager Raw Materials Portfolio, Beiersdorf)

»Beiersdorf and Evonik work together closely together in the area of sustainability. Both companies have set clear goals for sustainable formulations and the related raw materials. Evonik helps Beiersdorf develop sustainable solutions and solve joint problems such as the complete reworking of formulations and formulation platforms and the implementation of sustainability targets along the entire value chain. Sustainability is becoming increasingly important for the business relationship between Evonik and Beiersdorf, because sustainability criteria are a source of additional value, which is also reflected in the value chain.«

Jörg Prante
(Business Director Central Europe, Evonik)

Julia Beier and Peter Becker in discussion at the modern workspace at the Beiersdorf Campus.

Evonik's Care Solutions business line works closely with Beiersdorf to implement sustainability and transform the portfolio. The two companies set up the Sustainability Campus to address sustainability at product level and quantify its effects. The campus allows the companies to collaborate across functions. We are taking joint steps towards innovative skincare products that are more sustainable. Sustainable procurement of raw materials is important to us because we have a responsibility to the environment and society and want to make sure that our procurement chains are as sustainable as possible.«

Peter Becker (Senior Sustainability Manager, Evonik)

Beiersdorf's sustainability team is closely networked with all functions, as well as with our strategic suppliers, in order to implement our ambitious sustainability agenda CARE BEYOND SKIN. This includes our responsible sourcing program, which we use to pursue demanding targets such as using renewable and certified sustainable raw materials and packaging. At the end of 2020, we achieved an important milestone: switching our primary packaging entirely to sustainability-certified palm (kernel) oil-based raw materials (certified by RSPO) and FSC-certified paper. Our commitment also extends to our supply chain: Together with Evonik, we support WWF Germany in two palm oil projects in Indonesia and Malaysia. The aim is to stop deforestation and train local smallholders to grow sustainable palm oil crops that can be certified as conforming to the RSPO standard. Here, we can jointly have a valuable local impact in the regions where the product is cultivated.«*

Julia Beier (Sustainability Manager Responsible Sourcing, Beiersdorf)

** Roundtable on Sustainable Palm Oil*

As Chief Scientist Feedstock & Formula Science at Beiersdorf, I develop the feedstock strategy for our cosmetic raw materials and help put it into practice. In the selection of raw materials, not only safety, tolerability, performance and formulating properties play a central role, also sustainability. Identifying optimal raw materials, in other words, materials that have a good safety and performance profile yet are eco-friendly in the long term, is the daily focus of our R&D team. One specific project we have been working on together with Evonik is the Kopernikus project. As part of the Power to X subproject, we worked on the CCU technology (carbon dioxide capture and utilization) to produce cosmetic and other chemical raw materials from CO_2. It's a very exciting field. We collaborate in interdisciplinary teams with experts from Beiersdorf and Evonik to achieve the best results.«

Dr. Manuela Köhler
(Chief Scientist Feedstock & Formula Science, Beiersdorf)

Dr. Achim Friedrich at Beierdorf's Nivea store.

Fossil-based resources are widely used in the cosmetic industry because they are safe and readily available. However, their negative image and their role in the climate debate drive companies like Beiersdorf to transition to a more sustainable product product portfolio by reformulating their products. That is a real challenge because the product properties, especially what they feel like, must be preserved. Evonik has been developing sustainable raw materials for years and we work closely with Beiersdorf to provide a range of sustainable raw materials for their reformulation efforts. This collaboration benefits consumers as well as both companies because it accelerates the transition to more sustainable products, which in turn helps protect the environment and reduce their carbon footprints.«

Dr. Achim Friedrich
(Global Head of Applied Innovation Skin Care, Evonik)

»Sustainability in procurement means taking a new approach. For us, it means diving far deeper into our supply chains, as well as questioning and optimizing our processes and procurement structures constantly with regard to sustainability. Next to respecting human rights and meeting social standards, the development and purchasing of sustainable raw materials are central tasks for us. We aspire to integrate our entire value chain into our transformation and, at the same time, maintain our high quality standards, safeguard the availability of supply, and ensure a competitive cost structure. We want to actively drive the transformation of our industry and for that, we need strong partnerships like the one between Beiersdorf and Evonik.«

Julia Niedermeier (Head of Procurement Raw Materials Sourcing, Beiersdorf)