



Climate Program

2022

1. The Company

The Bayer Group comprises 354 consolidated companies in 84 countries throughout the world and employs 101,369 people. Its headquarters is in Leverkusen, Germany. Sales at the Bayer Group in 2022 amounted to €50.7 billion.

1.1 Corporate Profile

We are a life science company and a global leader in healthcare and nutrition. Our innovative products support efforts to overcome the major challenges presented by a growing and aging global population. We help prevent, alleviate and treat diseases. We also aim to ensure the world has a reliable supply of high-quality food, feed and plant-based raw materials. As part of this endeavor, the responsible use of natural resources is always a top priority. In line with our vision “Health for all, hunger for none,” we aim to put an end to hunger and help everyone lead a healthy life, while at the same time protecting ecosystems. That is what we aspire to achieve, guided by our purpose “Science for a better life.”

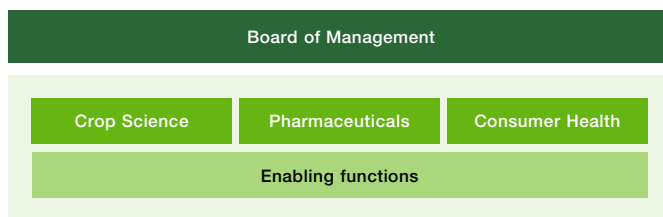
We aim to continuously enhance our company’s earning power and create value for customers, patients, shareholders, employees and society. Growth and sustainability are integral parts of our strategy, while our corporate values of leadership, integrity, flexibility and efficiency, or [LIFE](#) for short, lay the foundation for the way we operate. These values shape our culture and ensure a common identity throughout the Bayer Group. Based on this, our [Bayer Societal Engagement](#) (BASE) principles provide clear orientation for communicating with social interest groups.

1.2 Corporate Structure

Corporate structure as of December 31, 2022

As the parent company of the Bayer Group, Bayer AG – represented by its Board of Management – performs the principal management functions for the entire enterprise. This mainly comprises the Group’s strategic alignment, resource allocation, and the management of financial affairs and managerial staff, along with the management of the Group-wide operational business of the Crop Science, Pharmaceuticals and Consumer Health divisions. The enabling functions support the operational business.

Structure of the Bayer Group 2022



Our divisions are active in the following areas:

Crop Science

Crop Science is the world’s leading agriculture enterprise, with businesses in crop protection, seeds and traits, and digital farming. We offer a broad portfolio of high-value seeds, improved plant traits, innovative chemical and biological crop protection products, digital solutions and extensive customer service for sustainable agriculture. We market these products primarily via wholesalers and retailers or directly to farmers. In addition, we market pest and weed control products and services to professional users outside the agriculture industry. Most of our crop protection products are manufactured at the division’s own production sites. Numerous decentralized formulation and filling sites enable the company to respond quickly to the needs of local markets. The breeding, propagation, production and/or processing of seeds, including seed dressing, take place at locations close to our customers, either at our own facilities or under contract.

Pharmaceuticals

Pharmaceuticals concentrates on prescription products, especially for cardiology and women's healthcare, and on specialty therapeutics focused on the areas of oncology, hematology, ophthalmology and, in the medium term, cell and gene therapy. We have established a strategic unit for cell and gene therapy spanning the entire value creation chain – from research and development to marketing and patients. The division also comprises the radiology business, which markets diagnostic imaging equipment and digital solutions together with the necessary contrast agents. Our portfolio includes a range of key products that are among the world's leading pharmaceuticals for their indications. The prescription products of our Pharmaceuticals Division are primarily distributed through wholesalers, pharmacies and hospitals.

Consumer Health

Consumer Health is a leading supplier of nonprescription (OTC = over-the-counter) medicines, nutritional supplements, medicated skincare products and other self-care solutions in the categories of pain, cardiovascular risk prevention, dermatology, digestive health, allergy, and cough & cold. The products are generally sold by pharmacies and pharmacy chains, supermarkets, online retailers and other large and small retailers.

Enabling functions

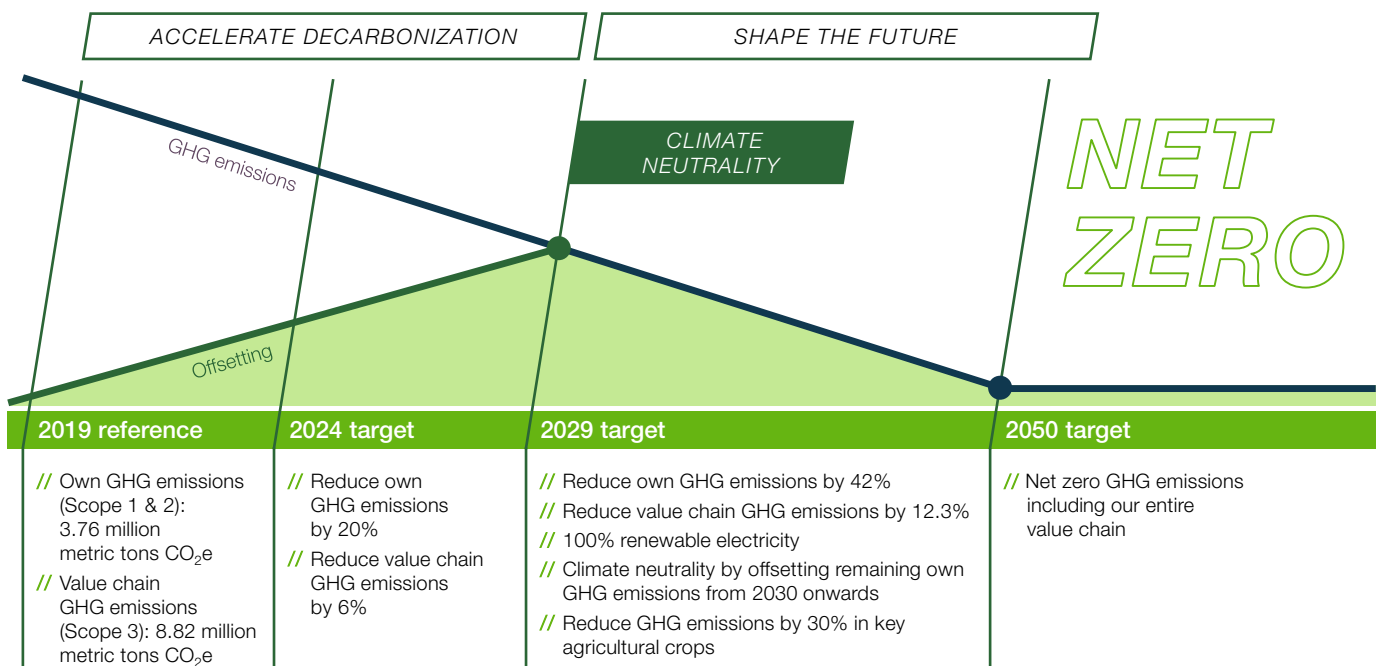
The enabling functions, such as Public Affairs, Science, Sustainability & HSE; Group Finance; Information Technology; and Human Resources, serve as Group-wide competence centers and bundle business support processes and services for the divisions. Our [Leaps by Bayer](#) unit, which invests in disruptive innovations, also forms part of the enabling functions.

For more information on the divisions' products and activities and the distribution of sales across the divisions and our global sites, please see our [2022 Annual Report](#).

2. Climate Protection

Climate change affects us all and is one of the greatest challenges that humankind will face in the future. Bayer considers climate protection and the related reduction of greenhouse gas emissions to be a top priority. We support the Paris Agreement and the objective of limiting global warming to 1.5 °C relative to the preindustrial level. [The Science Based Targets initiative](#) (SBTi) has validated our target and confirms our contribution to fulfilling the Paris Agreement. We anticipate that our business areas of healthcare and agriculture will on the one hand be impacted by climate change, but on the other will also be part of the solution.

Roadmap to Net Zero



GHG = greenhouse gas

2.1 Management Approach

The Chairman of the Board of Management holds direct responsibility for climate protection in his role as Chief Sustainability Officer. In keeping with their level of importance, climate-change-related topics and Bayer’s climate strategy were discussed at a total of three meetings of the Board of Management, two meetings of the Supervisory Board and two meetings of the ESG Committee of the Supervisory Board in 2022. The attainment of our Group target of reducing greenhouse gases by 2030 is factored into the long-term compensation of the Board of Management and Bayer’s LTI-entitled managerial employees. The compensation-relevant target is based on Bayer’s necessary contribution to an SBTi-validated 1.5 °C scenario. Climate protection is also an integral element of annual variable compensation.

In addition, the [Sustainability Council](#) that was established in 2020 advises the Board of Management in all matters relating to sustainable development – including climate protection. In 2022, climate change and the related impacts and opportunities for Bayer were discussed at two meetings of the Sustainability Council.

The Chairman of the Board of Management is supported in this by the Public Affairs, Science, Sustainability & HSE Enabling Function and the sustainability departments within the divisions. The divisions handle the operational implementation of the climate protection measures at their sites with the support of the enabling functions. We have formed Group-wide working groups for the strategic and operational implementation of climate-change-related measures and a special working group to analyze various climate scenarios and their impacts on our business.

2.2 Climate Strategy

Net zero target

Bayer has undertaken to achieve a net zero target for greenhouse gas emissions throughout the entire value chain by 2050 or earlier. As an external expression of commitment to net zero greenhouse gas emissions, the company also signed the [Business Ambition for 1.5 °C](#), a campaign of the SBTi in partnership with the UN Global Compact and the [We Mean Business Coalition](#).

Medium-term climate targets by 2030

Bayer aims to achieve climate neutrality at all its own sites by 2030. To attain that target, we intend to reduce our own emissions – the so-called Scope 1 and Scope 2 emissions – by 42% relative to the reference year 2019 by the end of 2029. This target on the pathway to a 1.5 °C scenario was reviewed and acknowledged by the SBTi.

We have set a reduction target for Scope 3 emissions of 12.3% by 2029 (relative to 2019) for our value chain. This target was also reviewed and acknowledged by the SBTi.

Interim targets by 2024

By 2024, we aim to reduce our own (Scope 1 and Scope 2) emissions by 20% and our emissions in the value chain (Scope 3) by 6% (relative to 2019) in line with the reduction pathway of our Science Based Target (SBT).

Measures

We have developed a net zero roadmap to achieve our ambitious climate targets. This roadmap comprises various measures in the areas of energy and efficiency, governance and offsetting. To implement our long-term climate strategy, we focus on reducing the greenhouse gas emissions associated with our operations and on strengthening the resilience of our business areas.

Electricity from renewable energies

- // By 2029, we intend 100% of the electricity we purchase to be derived from renewable sources.
- // We have defined specific criteria for the procurement of renewable electricity and this information is published on our [website](#). These criteria include the geographical proximity between power generation locations and Bayer's sites, the use of new production sources and a focus on wind and solar energy. The criteria are based on the [next-generation green power guidelines](#) of the WWF (World Wide Fund for Nature).
- // In 2022, we pressed ahead with the conversion of our Group-wide electricity procurement, and renewable energies now account for 32.6% of our total purchased electricity volume.
- // For example, in 2022 we concluded a long-term supply agreement for our sites in Spain with a producer of electricity generated from renewable energies. Similar supply agreements already exist for sites in Germany and Mexico. In Brazil, long-term supply agreements were concluded to ensure the supply of electricity from renewable energies based on energy attribute certificates (EACs) accredited according to the International Renewable Energy Certificate standard (I-REC). Part of the electricity requirement in the United States is covered by certificates (EACs/RECs), supplemented by supply agreements with local providers.

Investment in energy efficiency and renewable energies

- // To achieve an absolute reduction in our remaining emissions, we intend to invest €500 million in renewable energies and in increasing the energy efficiency of our facilities and buildings by 2030.

- // We are investing in process innovations, more efficient facilities and building technology, and in the implementation and optimization of energy management systems, particularly at our production sites.
- // Capital expenditure projects are underway at various sites to advance the use of climate-neutral technologies such as geothermal energy or emissions-free steam production.
- // One example is the planning of an adiabatic crystallizer at one of our energy-intensive production sites in the United States.
- // Using improved data visualization, unusually high energy consumption was identified at a production site in Germany (through “bad actor analysis”) and rectified through capital expenditures to enable steam consumption to be reduced at the site.
- // In the vacuum generation process at a production site in India, a thermal exhaust vapor compressor was replaced with a mechanical exhaust vapor compressor, thus considerably reducing steam consumption at the site.
- // At another production site, the repair of condensate drains has enabled a considerable reduction in steam consumption in recent years.

Vehicle fleet

- // By 2030, we aim for our fleet of currently around 26,000 vehicles to consist entirely of electric vehicles wherever this is technically and economically feasible.
- // Bayer joined the [EV100](#) initiative of the [Climate Group](#) and has validated its activities according to the criteria of that initiative. In 2022, implementation began in 26 countries (including Germany) that account for around 67% of our vehicle fleet. Including vehicles that have already been ordered, the proportion of hybrid and electric vehicles in our fleet is approximately 18%.

Governance

- // Capital investment and an internal CO₂ price: we are aligning our capital expenditures to our goal of achieving net zero greenhouse gas emissions by 2050. This is in line with the international goal of limiting global warming to 1.5 °C. To drive this transition, we have launched a pilot project and established an internal CO₂ price of €100 per metric ton of CO₂ for the calculation of our capital expenditure projects. Beginning in 2023, we also aim to develop an internal CO₂ price to manage our Scope 3 emissions.
- // Investment decisions: we perform a voluntary ecological assessment for capital expenditure projects exceeding €10 million. Emissions reduction and efficiency measures are integral to these evaluations. For more information, please see Chapter 8. Environmental Protection and Safety in our [Sustainability Report 2022](#).
- // Certifications according to the international ISO 14001 (environmental management) and ISO 50001 (energy management) standards help to identify energy savings potential both in existing production processes and in the development of new production processes and the conversion of existing processes. These standards support us in managing and reducing energy consumption at our production sites. For more information, please see Chapter 8. Environmental Protection and Safety in our [Sustainability Report 2022](#).
- // Through transparency, we want to motivate our employees in a variety of different areas to consume energy and electricity efficiently. For example, in one office building in Germany, electricity consumption is displayed visually for employees to see. Best practices (sustainability moments) are shared in various areas.

Climate neutrality

- // We will offset those of our emissions (Scope 1 and 2) that still remain following reduction through technological measures and cannot be avoided (such as greenhouse gas emissions generated by chemical processes or through business travel) by purchasing certificates from climate protection projects that meet recognized quality standards. By doing so, we aim to achieve climate neutrality for our own sites by 2030. These projects need to have a connection to our business. In this respect, too, we have established specific criteria for procuring certificates from climate protection projects. In this process, we focus on nature-based climate solutions, preferably concerning forestry and agriculture projects. We will also invest in innovative projects to promote the development of voluntary emissions trading. On our [website](#), we report on our strategy and the projects we support.
- // We offset more than 450,000 metric tons of our greenhouse gas emissions in 2022 by financing reforestation and forest conservation projects, for example in Brazil, Guatemala, Indonesia, Nicaragua, Peru, Zambia and Zimbabwe.

// In 2022, we joined the [Brazilian Initiative for the Voluntary Carbon Market](#). This initiative brings together companies and institutions from several industries in Brazil with the goal of structuring key measures to develop voluntary CO₂ emissions trading in that country and to contribute to global CO₂ emissions trading with accredited certificates.

LEAF Coalition

The destruction of forests is a pressing global challenge, especially considering that forest conservation is one of the most important measures for protecting biodiversity and the climate.

Within the framework of its activities to protect forests, Bayer is a participant in the [LEAF](#) (Lowering Emissions by Accelerating Forest finance) Coalition. LEAF has mobilized more than US\$1.5 billion since 2021 to initiate the biggest public-private effort to protect the rainforests.

We clearly advocate enforcement of the corresponding laws to protect the Amazon rainforest, which also involves driving forward the sustainable intensification of agriculture in Brazil to prevent further deforestation.

Certificates from activities undertaken in connection with LEAF are expected to be part of our offsetting portfolio beginning in 2023.

Value chain (Scope 3)

By 2029, we aim to reduce greenhouse gas emissions along the upstream and downstream value chain (Scope 3) by at least 12.3% (reference year 2019) through cooperation with suppliers and customers. This target was validated and acknowledged by the [Science Based Targets initiative](#) (SBTi). As the ability of one company on its own to reduce greenhouse gas emissions along the value chain is only limited, Bayer has joined together with other companies within various initiatives. Together, we aim to ascertain the level of greenhouse gas emissions and climate risks and develop reduction targets and strategies within the scope of programs such as the [Together for Sustainability](#) (TfS) initiative of the chemical industry.

Bayer heads up the working group on reducing greenhouse gas emissions in the supply chain. The goal is to standardize the calculation of a product-related carbon footprint (PCF) for the chemical industry. At the same time, an approach is being developed to pass on the PCF within the value chain. The plan is to share results from the TfS working group with the [Partnership for Carbon Transparency](#) (PACT) of the [World Business Council for Sustainable Development](#) (WBCSD). PACT develops climate approaches across industries. As a member of the WBCSD, we are working on suitable measures there as well.

Through the Supply Chain Initiative of [CDP](#) (formerly the Carbon Disclosure Project), we ask our strategically important suppliers and those who account for a significantly high proportion of our emissions in the value chain to provide us with more exact greenhouse gas emissions data. Using the methods of the Supply Chain Initiative, we aim to learn more about the greenhouse gas emissions of our suppliers and the share of these emissions attributable to products and services sourced by us. We also ascertain reduction targets and the use of renewable energies. The goal is to better integrate data collected by our suppliers into the calculation of our emissions for the value chain. By applying the Supply Chain Initiative methods, furthermore, we aim to identify potential for reducing greenhouse gas emissions among our suppliers and incorporate this potential into our supplier development efforts (please see also Chapter 4.2 Sustainability in the Supply Chain in our [Sustainability Report 2022](#)).

In 2021, we – like our biggest transport and logistics partners and various industrial companies – began to implement the IT solution [EcoTransIT World](#) for automatic calculation of transport-related greenhouse gas emissions. EcoTransIT World is geared toward continuously evolving and harmonizing the methods for determining emissions in the transport sector worldwide and thus creating a globally recognized methodology. Bayer is also a member of the EcoTransIT World Initiative.

Furthermore, we take advantage of the [Pharmaceutical Supply Chain Initiative](#) (PSCI) working group to engage in dialogue within the pharmaceutical industry about measures to reduce Scope 3 emissions.

For more information on our target of reducing greenhouse gas emissions in agriculture by 30%, please see also the Focus on: Agriculture chapter in our [Sustainability Report 2022](#).

Climate policy engagement

Externally, we advocate for a climate position in line with our ambitious targets and demand that our partners also undertake decarbonization measures in accordance with the Paris Agreement. We have therefore published a detailed list of our [climate policy lobbying](#) activities.

In line with our goals, we critically scrutinize our memberships in relevant industry associations and their positions as regards climate policy measures. The analysis forms the basis for Bayer's further efforts to advocate for scientifically founded policies to combat climate change through its member associations. In developing this approach, we have worked together with [Climate Action 100+](#), an investor initiative that cooperates with the world's biggest industrial companies on the issue of climate change.

To ensure maximum transparency in this process, Bayer has published the results in the [Industry Association Climate Review](#) since 2021. This report compares the climate policy positions of our industry associations with our own climate goals. As our industry associations represent us in the public debate, we disclose where we agree with these positions and where they diverge from ours. It is of paramount importance to us that we maintain a dialogue with our associations to achieve an amicable solution. Where differences exist, dialogue enables us to take measures to close these gaps. We disclose both our achievements and the challenges that still lie ahead of us in our current [Industry Association Climate Review – Engagement Update 2022](#).

Climate reporting

We have committed to transparently communicating our climate targets and progress, as well as the impact that climate change has on Bayer.

Through our longstanding and continuous participation in [CDP](#), we disclose our climate-related activities and progress with a high degree of detail.

Bayer supports the recommendations of the [Task Force on Climate-Related Financial Disclosures](#) (TCFD) with respect to reporting on this topic. In our report, we implement the 11 recommendations of the TCFD in the four categories of Governance, Strategy, Risk Management and Metrics & Targets. For more information, please see our separate [TCFD report](#).

On our [website](#), we report on our strategy to offset greenhouse gas emissions and the projects we support.

2.3 Risk and Opportunity Analysis

In 2022, we looked at the risks and opportunities stemming from the effects of climate change from various perspectives to better evaluate them in relation to our company and integrate them into our strategy and measures. Climate-related risks are already accounted for in our Group-wide Enterprise Risk Management (ERM) system.

Climate scenarios

We analyze the possible effects of climate change across two different scenarios. We use these scenarios to understand the impact of this factor on our business and to identify measures for mitigating risks and leveraging opportunities. With a cross-functional, cross-divisional team, we have identified relevant opportunities and risks for our business in both scenarios.

Building on [Assessment Report 6](#) of the Intergovernmental Panel on Climate Change (IPCC) and supplemented with further sources relevant to our business areas, we have drafted our scenario description. The basis comprises an optimistic scenario concerning climate change with warming of below 2 °C – the “Green Road” SSP1-2.6 (temperature increase of 1.8 °C by 2100 compared with the preindustrial age) – and one that is aligned to current global behavior – the “Rocky Road” SSP3-7.0 (temperature increase of 3.6 °C).

The [Emissions Gap Report 2022 of the UN Environment Programme \(UNEP\)](#) presumes that the current political reduction targets are far too low to reach the goal of the Paris Agreement. UNEP assumes that the current national reduction targets will result in an average global warming of 2.8 °C in 2100. At the same time, our optimistic scenario (Green Road) seems unrealistic in view of the current global developments and crises. Both scenarios (Green Road and Rocky Road) are important for assessing Bayer’s climate-related risks, and we will therefore continue to analyze both scenarios in detail.



Green Road (SSP1-2.6)

- // The Green Road scenario assumes a rise in average global temperature compared with the preindustrial age of 1.7 °C by between 2041 and 2060. Between 2081 and 2100, the temperature is likely to have risen by 1.8 °C compared with the preindustrial age.
- // This scenario is marked by the rapid implementation of ambitious and globally coordinated climate-related laws and rules that in the short term can also include transformational requirements and new regulations for companies. The rapid reduction in greenhouse gas emissions leads to less severe weather- and climate-related effects.



Rocky Road (SSP3-7.0)

- // The Rocky Road scenario assumes the rise in average global temperature compared with the preindustrial age to be around 2.1 °C by between 2041 and 2060, and probably 3.6 °C by between 2081 and 2100.

- // In this scenario, we expect less ambitious laws and provisions that will vary widely from one region to another, leading to a slower pace of emissions reduction and thus more intensive weather- and climate-related changes in all regions of the world. The varying levels of ambition also lead to additional trade barriers that can be manifested in measures such as a Carbon Border Adjustment Mechanism (CBAM).

In our analysis of the effects of climate change, we go beyond the customary Enterprise Risk Management time horizons and instead apply the following time horizons:





















































































































- // Short-term (2021–2025)
- // Medium-term (2026–2035)
- // Long-term (2036–2050)

In 2022, we developed our own agricultural climate model for the first time to analyze the impacts on agricultural productivity depending on the various scenarios.

Climate impact drivers

Based on the overarching description, we have identified nine climate impact drivers of materiality for Bayer so as to analyze the effects regulatory and physical changes will have on our business in more detail. The goal of the analysis is to identify the relevance and change potential in relation to Bayer and our fields of business and to derive suitable measures.

Separately, we assess the opportunities and risks associated with the nine climate impact drivers shown in the graphic – in each case based on the various time horizons and on the Green Road and Rocky Road scenarios.

Climate Impact Drivers		Short term (2021–2025)		Medium term (2026–2035)		Long term (2036–2050)	
		Risk	Opportunity	Risk	Opportunity	Risk	Opportunity
Transitional impact drivers							
Laws, regulations, policies							
							
Carbon taxation/pricing, carbon border adjustment & offsetting							
							
Commodity prices							
							
End customer/customer/market							
							
Food security							
							
Acute physical impact drivers							
Extreme weather events							
							
Chronic physical impact drivers							
Permanent water cycle							
							
Diseases							
							
Temperature							
							
The Green Road (SSP1-2.6) =  The Rocky Road (SSP3-7.0) =  Relevance = low    high							

Below we provide insight into the assessments of the individual climate impact drivers.

Transitional impact drivers

Based on the Paris Agreement, the most important countries and regions in which Bayer operates have committed

to limiting global warming by reducing their greenhouse gas emissions.

- // One example is the European Union's Green Deal, the goal of which is to accelerate the transition to an emissions-free future and achieve climate neutrality by 2050. Consequently, the EU is expected to further increase costs for the emission of greenhouse gases (e.g. through CO₂ regulations such as the EU emissions trading system (EU-ETS) or a carbon tax), adjust financing incentives (e.g. through the EU taxonomy) and drive forward technological changes (e.g. through the promotion of renewable energies and hydrogen technologies).
- // China has committed to attaining net zero emissions by 2060 and is therefore expected to introduce further regulations in this connection.

Through our strategy for achieving climate neutrality and reducing greenhouse gas emissions on the pathway to a 1.5 °C scenario, we are reducing the risk of additional costs caused by the expected regulations.

We continuously analyze the further effects of regulatory changes on our business. National and international CO₂ reduction targets could lead to the abandonment of fossil fuels and impact the demand for fuels from biomass (biofuels), for example. Depending on the regulators' decision, this could lead to either increased or reduced demand for biofuels. This decision could impact our sales markets, as some of our customers grow corn for the production of biofuels.

As one of the world's biggest CO₂ emitters, the agriculture industry can also play a key part in protecting the climate and thus mitigating climate risks – for example through the capture of CO₂ in farmland. For more information on our target of reducing greenhouse gas emissions in agriculture by 30%, please see the Focus on: Agriculture chapter in our [Sustainability Report 2022](#).

Physical impact drivers

Weather and climate effects are of particular significance for the Crop Science Division and are accounted for in both strategic planning and the seasonal business risk. These effects are intensifying as a result of climate change, and both short-term (extreme) weather events and long-term climate changes will increase further.

Acute physical impact drivers

All climate models anticipate an increase in extreme weather conditions (such as drought, heavy rains and storms) that present an elevated risk of crop losses and therefore also pose risks for the agricultural value chain as a whole. Despite all precautions, operations at our sites or those of our customers may be disrupted and crop failures may occur

as a result of extreme weather events and natural disasters. In the IPCC forecasts, the intensity of such events varies widely from one region to the next. In the IPCC's regional fact sheets for the [Central North America](#) (CNA) region, for example, extreme precipitation is predicted to increase; the [South American Monsoon](#) (SAM) region is expected to experience both a delay in the monsoon season and intensified droughts.

In addition to risks, however, climate change can also create opportunities for our business. Bayer's product range and innovative capability – particularly in the agricultural value chain – will create a foundation for leveraging new options and sales opportunities in the future against the background of climate change. As a seed producer, we already offer plants with increased resistance to extreme weather conditions, including short-stature corn that is less susceptible to storms (for more information, please see the Focus on: Agriculture chapter in our [Sustainability Report 2022](#)).

We also enable farmers to react better and more quickly to extreme weather conditions with our FieldView™ digital farming platform. For more information, please see Chapter 3.6 Crop Science in our [Sustainability Report 2022](#).

Chronic physical impact drivers

The long-term natural and physical effects of climate change will have a particular impact on the permanent water cycle (for example through a transition to a wetter or drier climate or a delay in the monsoon season), the spread of diseases and insect pests, and further coupling effects of temperature changes. These effects will be particularly relevant for our agricultural business.

We develop strategies to help farmers increase their resilience against the effects of climate change. At the same time, we want to help farmers reduce their own greenhouse gas emissions and cultivate healthy crops. As there are no uniform solutions in agriculture, farmers need numerous options from which they can select the most suitable for their fields and the prevailing local conditions.

In addition, health risks such as cardiovascular disease can also intensify due to hotter summer months or more frequent heatwaves. This could create increased demand for products for cardiovascular disease or nutritional supplements.

Next steps

As data models and insights into climate change are constantly evolving, we will continue to expand and refine our scenario description and analysis in 2023 and beyond. At the same time, we are enhancing our analytical capabilities and expanding our climate models e.g. in order to better understand how various climate zones are changing. By doing this, we want to be in a position to describe future challenges and opportunities as accurately as possible to derive short-, medium- and long-term mitigation measures. Findings from these analyses will play a bigger role in our strategic, portfolio and operational processes.

We also participate in the Value Chain Risk to Resilience working group of the international [Business for Social Responsibility](#) network. In addition, we have developed agriculture- and forestry-specific scenario descriptions together with a working group of the WBCSD. Through dialogue in various forums and with different stakeholders, we improve our own analyses and aim to help improve the identification of regulatory and physical climate risks and climate resilience measures throughout the entire supply chain.

2.4 Greenhouse Gas Emissions

At Bayer, air emissions are primarily caused by the combustion of primary energy sources such as gas and oil. These are used to generate electricity, steam and auxiliary energy (such as for heating and cooling) for the manufacture of our products. Further emissions derive from chemical processes in which coal and other energy sources are required to produce chemical reactions. Emissions are also generated by our vehicle fleet and in the extraction and processing of raw materials.

In reporting greenhouse gas emissions, we take account of the recommendations of the Greenhouse Gas Protocol (GHG Protocol). Direct emissions from our own power plants, vehicles, waste incineration plants and production facilities (Scope 1) and indirect emissions from the procurement of electricity, steam and cooling energy (Scope 2) are determined at all environmentally relevant sites whose annual energy consumption exceeds 1.5 terajoules. In this connection, we have drafted Group regulations for the Group-wide recording of greenhouse gas emissions. In line with the GHG Protocol, we report indirect emissions (Scope 2) according to both the location-based and the market-based method.

Bayer's greenhouse gas emissions fell further in 2022 compared to 2021. We succeeded in reducing our own Scope 1 and Scope 2 emissions by 4.5%, or around 142,000 metric tons, particularly by increasing the share of our electricity derived from renewable energies. Overall, we have already reduced our own emissions (Scope 1 and Scope 2) by 19.5% compared with the reference year 2019.

We address our climate protection activities in detail in our latest [Report to CDP](#) (formerly the Carbon Disclosure Project).

Greenhouse Gas Emissions (Scope 1 and 2)			
Million metric tons of CO ₂ equivalents	2020	2021	2022
Scope 1: Direct emissions ¹	2.01	1.93	1.91
of which carbon dioxide (CO ₂)	1.96	1.90	1.85
of which ozone-depleting substances	0.011	0.011	0.011
of which partially fluorinated hydrocarbons (HFCs)	0.022	0.014	0.039
of which nitrous oxide (N ₂ O)	0.008	0.007	0.007
of which methane (CH ₄)	0.003	0.003	0.003
Scope 2: Indirect emissions ² according to the location-based method	1.75	1.56	1.56
Scope 2: Indirect emissions ² according to the market-based method ³	1.57	1.24	1.12
Total greenhouse gas emissions (Scope 1 and 2) according to the market-based method³	3.58	3.17	3.03
of which offset greenhouse gas emissions ⁴		0.3	0.45
Specific greenhouse gas emissions (kg CO ₂ e/€ thousand external sales) according to the market-based method ^{3, 5}	86.55	71.95	59.72

¹ In line with the GHG Protocol, we also report the direct emissions resulting from the generation of energy for other companies that is sold as a site service. In 2022, these emissions corresponded to 0.13 million metric tons of CO₂ equivalents.

² Typically, CO₂ accounts for 97% of all energy-related greenhouse gas emissions. When determining indirect emissions, our calculations are therefore limited to these greenhouse gases and we indicate all emissions in CO₂ equivalents.

³ For Bayer, the market-based method of the GHG Protocol most reliably reflects the values for Scope 2 emissions and the success of emissions reduction measures, so we apply emissions volumes calculated using this method when calculating the total and specific greenhouse gas emissions.

⁴ Corresponds to a share of 14.9% of Scope 1 and 2 emissions in 2022

⁵ Specific Bayer Group emissions are calculated by adding together direct emissions and indirect emissions calculated using the market-based method of the GHG Protocol (Scope 2), then dividing the total volume by the external sales volume.

In 2022, Bayer participated in European emissions trading with a total of five plants. The CO₂ emissions of these plants amounted to more than 290,000 metric tons. Due to the varying depth of value creation, direct and indirect greenhouse gas emissions (Scope 1 and Scope 2) are unequally distributed among our divisions. Our raw material extraction activities, including treatment and downstream processing, for the manufacture of the crop protection intermediates of Crop Science are especially energy-intensive – this division therefore accounts for the greatest share of our greenhouse gas emissions.

Greenhouse Gas Emissions by Division (Scope 1 and 2)

Million metric tons of CO ₂ equivalents	2020	2021	2022
Scope 1: Direct emissions ¹	2.01	1.93	1.91
of which Crop Science	1.65	1.61	1.58
of which Pharmaceuticals	0.19	0.18	0.18
of which Consumer Health	0.02	0.02	0.02
of which other ²	0.16	0.13	0.14
Scope 2: Indirect emissions ³ according to the market-based method ⁴	1.57	1.24	1.12
of which Crop Science	1.38	1.06	0.93
of which Pharmaceuticals	0.13	0.12	0.11
of which Consumer Health	0.06	0.05	0.05
of which other ²	0.004	0.003	0.03

¹ In line with the GHG Protocol, we also report the direct emissions resulting from the generation of energy for other companies that is sold as a site service.

² These include greenhouse gas emissions from the vehicle fleet and emissions caused by the enabling functions.

³ Typically, CO₂ accounts for 97% of all energy-related greenhouse gas emissions. When determining indirect emissions, our calculations are therefore limited to these greenhouse gases and we indicate all emissions in CO₂ equivalents.

⁴ For Bayer, the market-based method of the GHG Protocol most reliably reflects the values for Scope 2 emissions and the success of emissions reduction measures, so we apply emissions volumes calculated using this method when calculating the total and specific greenhouse gas emissions.

Value chain (Scope 3)

The GHG Protocol Corporate Value Chain (Scope 3) Accounting & Reporting Standard bindingly regulates the reporting of all indirect greenhouse gas emissions from the value chain and separates these emissions into 15 categories. Emissions from eight Scope 3 categories are of material importance to Bayer and together account for our total Scope 3 emissions. We describe the procedures applied by Bayer in the individual categories in detail in the [Report to CDP](#).

Greenhouse Gas Emissions in the Value Chain (Scope 3)

Million metric tons of CO ₂ equivalents	2020	2021	2022
Scope 3: Indirect emissions from our upstream and downstream value chain (by materiality) ¹	8.91	8.69	9.64
of which indirect emissions from our upstream and downstream value chain to attain the SBT ^{2, 3}	7.93	7.91	8.90
of which (3.1) purchased goods and services	6.15	6.08	6.87
of which (3.2) capital goods	0.40	0.46	0.51
of which (3.3) fuel- and energy-related activities	0.63	0.63	0.55
of which (3.4) (upstream) transportation and distribution	0.70	0.71	0.82
of which (3.6) business travel	0.06	0.03	0.15
Progress in the reduction of Scope 3 emissions compared to the reference year 2019 ^{4, 5}	-10%	-10%	+1%

2021 figures restated

¹ Emissions from eight Scope 3 categories are of material importance to Bayer and together represent our total inventory of Scope 3 emissions: (3.1) purchased goods and services, (3.2) capital goods, (3.3) fuel- and energy-related activities, (3.4) (upstream) transportation and distribution, (3.5) waste generated in operations, (3.6) business travel, (3.7) employee commuting and (3.12) end-of-life treatment of sold products.

² Science Based Target

³ For the calculation of our reduction target for Scope 3 emissions in line with SBTi, 88% of total materially important Scope 3 emissions in the reference year 2019 are considered (target inventory). The following Scope 3 categories are covered: (3.1) purchased goods and services, (3.2) capital goods, (3.3) fuel- and energy-related activities, (3.4) (upstream) transportation and distribution and (3.6) business travel.

⁴ 2029 target: 12.3% reduction

⁵ All greenhouse gas emissions from air travel in 2020, 2021 and 2022 were offset.

In accordance with the guidelines of the Science Based Targets initiative (SBTi), the calculation of our reduction target for Scope 3 emissions utilizes only the five major categories that made up the biggest portion of our Scope 3 emissions (88%) in the reference year 2019. These are shown in the table on the left. For more information on initiatives to reduce Scope 3 emissions, please see Chapter 2.2 Climate Strategy.

Compared to 2021, the Scope 3 emissions relevant to our reduction target rose by around 0.99 million metric tons, corresponding to an increase of 12.5%. The rise in Scope 3 emissions is primarily due to business growth, the replenishment of inventories and an increase in air freight and business travel. The category 3.1 (purchased goods and services) accounts for the most significant share of our Scope 3 emissions, at 77%.

Total greenhouse gas emissions

In 2022, we reduced our total greenhouse gas emissions (Scope 1, 2 and 3) compared to the reference year 2019 by around 1.1 million tons, while our business has grown significantly over the same period. Regarding the reduction in our own emissions (Scope 1 and 2) we have already exceeded our targets, achieving a decline of 19.5% since 2019.

Reducing emissions in our value chain (Scope 3) is an increasing challenge in the face of a growing business. To achieve significant reductions in the supply chain in the coming years, we are intensifying our collaboration with suppliers, in particular in terms of a shift to renewable energies. We have also specified this in our updated Supplier Code of Conduct. Beginning in 2023, we also aim to develop an internal CO₂ price to manage our Scope 3 emissions. This should create an incentive internally to purchase products with a lower carbon footprint.

Total Greenhouse Gas Emissions (Scope 1, 2 and 3)

Million metric tons of CO ₂ equivalents	2019	2022
Total emissions according to the location-based method ¹	12.67	12.38
Total emissions according to the market-based method ²	12.58	11.93
Specific total emissions (kg CO ₂ e/€ thousand external sales) according to the location-based method ³	290.93	243.97
Specific total emissions (kg CO ₂ e/€ thousand external sales) according to the market-based method ⁴	288.87	235.13

¹ Total emissions according to the location-based method are calculated by adding together direct emissions (Scope 1) and indirect emissions calculated using the location-based method of the GHG Protocol (Scope 2), plus indirect emissions from our value chain. For the Scope 3 categories, we use the five categories of material importance to Bayer that represent our target inventory for total Scope 3 emissions: (3.1) purchased goods and services, (3.2) capital goods, (3.3) fuel- and energy-related activities, (3.4) (upstream) transportation and distribution and (3.6) business travel.

² Total emissions according to the market-based method are calculated by adding together direct emissions (Scope 1) and indirect emissions calculated using the market-based method of the GHG Protocol (Scope 2), plus indirect emissions from our value chain. For the Scope 3 categories, we use the five categories of material importance to Bayer that represent our target inventory for Scope 3 emissions (see above).

³ Specific total emissions according to the location-based method are calculated by adding together direct emissions (Scope 1) and indirect emissions calculated using the location-based method of the GHG Protocol (Scope 2), plus indirect emissions from our value chain, then dividing this total by the external sales volume. For the Scope 3 categories, we use the five categories of material importance to Bayer that represent the target inventory for our Scope 3 emissions (see above).

⁴ Specific total emissions according to the market-based method are calculated by adding together direct emissions (Scope 1) and indirect emissions calculated using the market-based method of the GHG Protocol (Scope 2), plus indirect emissions from our value chain, then dividing this total by the external sales volume. For the Scope 3 categories, we use the five categories of material importance to Bayer that represent our target inventory for Scope 3 emissions (see above).

2.5 Energy

Our energy needs have the greatest direct impact on our greenhouse gas emissions. Production accounts for the most significant share of our energy requirement, which depends on the production operations at the sites and the depth of our value chain (please see also Chapter 2.4 Greenhouse Gas Emissions).

Energy consumption

When calculating total energy consumption, we differentiate between primary and secondary energy consumption. The main source of primary energy consumed comprises fossil fuels that we use to generate electricity, steam and cooling energy for our own use and to a small extent for sale to other companies. Secondary energy consumption reflects the purchase of electricity, steam and cooling energy at our sites worldwide.

One of the targets we have set within the context of our climate strategy is to cover 100% of purchased electricity needs with renewable energies by 2030. To achieve this objective, we have produced a catalogue of criteria such as physical proximity to the production plant and [additionality](#). For more information, please see Chapter 2.2 Climate Strategy.

In 2022, around 32.6% of our purchased electricity was sourced from renewable energies. We concluded additional supply agreements for electricity generated from renewable energies in the United States, Brazil and Germany in 2022. We are thus on track to achieve our target of 100% in 2029.

Compared with 2021 (34.8 petajoules), Bayer's total energy consumption rose by around 1.8% to 35.5 petajoules in 2022. This includes both primary energy consumption, mainly of fossil fuels, and secondary energy consumption. This rise compared to 2021 is primarily due to an increase in production at the sites in Soda Springs, Idaho, and Luling, Louisiana, in the United States.

Energy Consumption			
TJ	2020	2021	2022
Primary energy consumption	17,836	18,071	17,525
Natural gas	10,911	10,682	10,287
Coal	566	608	571
Liquid fuels	2,901	2,653	2,688
of which for vehicle fleet/transport	2,480	2,194	2,121
Waste	416	499	481
Other ¹	932	1,068	1,162
Primary energy consumption for third-party companies	2,111	2,561	2,335
Secondary energy consumption	18,022	16,764	17,947
Electricity ²	12,166	11,059	12,359
of which electricity from power grid	11,451	8,325	8,335
of which electricity from renewable energies	715	2,734	4,024
Steam	4,485	4,381	4,259
of which steam from renewable energies	25	82	92
Steam from waste heat (process heat)	550	574	558
Cooling energy	691	632	631
Secondary energy consumption for third-party companies	131	118	140
Total energy consumption	35,858	34,835	35,472

¹ For example biomass

² The proportion of primary energy sources used in generating the electricity consumed depends on the respective electricity mix of our energy suppliers.

Primary and secondary energy consumption is usually dependent on the production volume: the more that is produced, the greater the energy consumption and also the associated greenhouse gas emissions. Energy management systems (such as in line with ISO 50001) help to identify potential energy savings both in production processes and when developing new production processes or converting existing ones. This not only conserves valuable energy resources but is also an economic factor because it enables long-term savings.

At various sites, we have implemented projects designed to produce electricity from renewable energies. For example, additional photovoltaic facilities are currently being installed at locations in Indonesia and the United States with a view to meeting part of the electricity requirement at those sites. Together with our energy provider, we have developed a concept at our Leverkusen site for generating both thermal and cooling energy by geothermal means. This facility is scheduled to come on stream in 2023.

In our [Report to CDP](#), we also describe the projects to save energy that have been implemented at various sites.

Energy efficiency

Bayer reports energy efficiency as the ratio of energy used to external sales. Energy efficiency improved compared with 2021.

Energy Efficiency			
kWh/€ thousand external sales	2020	2021	2022
Energy efficiency	241	220	194

For more information on our energy efficiency measures, please see Chapter 2.2 Climate Strategy.

Masthead

Published by

Bayer AG, 51368 Leverkusen, Germany

Public Affairs, Science, Sustainability & HSE

Daniel Scheiders

Email: daniel.schneiders1@bayer.com

Sebastian Leins

Email: sebastian.leins@bayer.com

Bayer on the internet: www.bayer.com

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