Evonik Carbon Footprint 2020
Evonik Industries

EVONIK
Leading Beyond Chemistry

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EVONIK
CARBON
FOOTPRINT

1

Summary

Protecting the climate and the environment represents a major global challenge. Evonik Industries (referred to below as Evonik) takes climate and environmental protection extremely seriously as a key element of its corporate responsibility. The company has therefore been compiling data not only on direct greenhouse gas emissions but also on indirect greenhouse gas emissions for selected relevant categories since 2008 (see Figure 1). Allocating emissions to their various sources along the value chain is of particular importance. Analyzing the full range of emissions, from the company's own production facilities, through various categories such as purchased energy and raw materials, transports, business travel, and production waste, to the ultimate disposal of products sold, creates a comprehensive greenhouse gas balance for the company.

The methodology for the report closely follows the Greenhouse Gas Protocol Corporate Standard (referred to below as the GHG Protocol) of the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD).[1] This standard for Scope 3 reporting by the chemical industry is further detailed in the Guidance for Accounting & Reporting Corporate GHG Emissions in the Chemical Sector Value Chain (referred to below as WBCSD Scope 3 Chemical Sector Guidance)[2] published by WBCSD Chemicals in January 2013, in whose preparation Evonik took an active part. Unless otherwise specified, the procedural instructions defined in the WBCSD Scope 3 Chemical Sector Guidance document were taken into account for compilation of the Evonik Carbon Footprint (ECF).

The important parameter here is the carbon footprint, or CO_2eq footprint. The carbon footprint indicates the amount of greenhouse gas emissions (CO_2 equivalent, also CO_2eq, i.e. CO_2 and other greenhouse gases defined in the GHG Protocol) produced by a company, a process or an individual product. The present report covers only the greenhouse gas emissions of Evonik's continuing operations. Other potential environmental impacts, including impacts on health and safety, do not fall within the scope of the Evonik Carbon Footprint and are discussed in other publications of Evonik (such as the Sustainability Report and the environmental declarations of individual sites).

The trend in greenhouse gas emissions of Evonik, not including the use phase of Evonik products (see section 2.3), is shown in Table 1.

To ensure uniform environmental reporting, starting in 2020, reporting of the Evonik Carbon Footprint was switched to a "fast close" process.

Table 2 shows greenhouse gas emissions along Evonik's value chain by category for 2020. The amount of greenhouse gas emissions decreased compared to the previous year to 23.1 million tons CO_2eq. Changes in emission volumes in the individual categories result, among other things, from the impact of the COVID-19 pandemic and the acquisition of PeroxyChem.[3] While most categories remained at around the same level, lower sales volumes led to a reduction in emissions in category 12 "Disposal and recycling of sold products".

Moreover, methodological refinements occurred. In particular, category 1 "Purchased chemical raw materials and packaging materials as well as indirect goods" was affected by the integration of supplies purchased for resale as well as the inclusion of supplier-specific information.

TABLE 1: Trend in greenhouse gas emissions along the value chain of Evonik Industries (excluding the use phase)

	2016	*2017*	*2018*	*2019*	*2020*
CO_2eq emissions in millions of metric tons	25.9	26.9	27.5	23.3[4]	**23.1**

TABLE 2: Greenhouse gas emissions along the value chain of Evonik Industries (excluding the use phase)

Scope	*Category*	*Greenhouse gas emissions in 2020 [millions of metric tons CO_2eq]*
Scope 1	Energy and process emissions of Evonik	4.8
Scope 2	Purchased energy (net, balance of purchased electricity and steam less sales of electricity and steam to third parties; market-based approach)	0.6
Scope 3	Category 1: Purchased chemical raw materials and packaging materials as well as indirect goods	10.0
	Category 2: Capital goods	0.4
	Category 3: Energy-related activities (outside of Scope 1 & 2)	0.6
	Category 4: Inbound transports of chemical raw materials	0.3
	Category 5: Disposal and recycling of production waste	0.5
	Category 6: Employee business travel	0.01
	Category 7: Employee commuting	0.08
	Category 8: Leased assets, upstream (company vehicles, electricity and heating of administrative buildings)	0.02
	Category 9: Outbound product transports	0.3
	Category 12: Disposal and recycling of sold products	5.5
Total		**23.1**

Differences in totals due to rounding.

[1] World Resources Institute, World Business Council for Sustainable Development:
· The Greenhouse Gas Protocol. A Corporate Accounting and Reporting Standard (Revised Edition 2004),
· Required Greenhouse Gases in Inventories, Accounting and Reporting Standard Amendment (2013),
· Corporate Value Chain (Scope 3) Accounting and Reporting Standard, Supplement to the GHG Protocol Corporate Accounting and Reporting Standard (2011)

[2] World Business Council for Sustainable Development: Guidance for Accounting & Reporting Corporate GHG Emissions in the Chemical Sector Value Chain (2013)

[3] Data considers the acquisition of PeroxyChem but not that of Porocel due to the late closing (03/11/2020).

[4] Corrected value. For more details, see footnotes 9 and 10 on page 19.

According to the specifications of the WBCSD Scope 3 Chemical Sector Guidance, Category 10 "Processing of sold products" is not to be included in the balance. Due to the highly diverse application areas of Evonik products, Category 11 "Use of products sold" is not part of the balance; in case of utilization by direct combustion (as for example with fuel additives), the emissions are considered in Category 12 "Disposal and recycling of sold products". Emissions of Categories 13 to 15 (Leased assets downstream, Franchises, and Investments) are not reported.

The Evonik-internal Life Cycle Management (LCM) team is responsible for compiling greenhouse gas emission data along the value chain. It uses a variety of tools such as life cycle assessments to quantify sustainability and to support business and decision-making processes. The LCM team is part of the business line "Process Technology & Engineering" within the Technology & Infrastructure division.

EVONIK'S PARTICIPATION IN THE CARBON DISCLOSURE PROJECT

The Carbon Disclosure Project (CDP) is a globally active non-profit organization that uses standardized questionnaires to collect data on greenhouse gas emissions, climate risks as well as companies' reduction targets and strategies every year as part of its "CDP Climate Change" program. The information is provided on a voluntary basis. Evonik was awarded a grade of "A-" in the 2020 CDP Climate Change reporting cycle. Evonik's rating thus improved again to the leadership band. By comparison, both the Chemical sector average and the average of European companies participating in the CDP Climate Change in 2020 are in the lower "C" range.

2

Methodology

The GHG Protocol provides the methodological framework for calculating and reporting the Evonik Carbon Footprint.

It contains guidelines for quantifying and reporting of greenhouse gases based on the following principles:

- **relevance,**
- **completeness,**
- **consistency,**
- **transparency, and**
- **accuracy.**

The GHG Protocol refers to CO_2 equivalence factors, which are used to convert greenhouse gases into CO_2 equivalents (CO_2eq) and thus enable to total all greenhouse gas emissions.[5]

The WBCSD Scope 3 Chemical Sector Guidance published in January 2013 describes standard procedures for implementing the requirements of the GHG Protocol for Scope 3 reporting of the chemical industry.

[5] Intergovernmental Panel on Climate Change (IPCC): Fifth Assessment Report (AR5): Climate Change 2013 – The Physical Science Basis, Chapter 8, Table 8.A.1

2.1 ORGANIZATIONAL BOUNDARIES

The Evonik Carbon Footprint was calculated for the continued activities of Evonik in accordance with the full consolidation approach, which was chosen to match the financial and environmental reporting of Evonik. Evonik is aware of the fact that this approach can lead to double-counting of greenhouse gas emissions in cases when two or more external companies holding shares of the same legal entity report their emissions. Emissions arising from discontinued activities are not reported.

2.2 REMARKS CONCERNING THE "FAST CLOSE" PROCESS

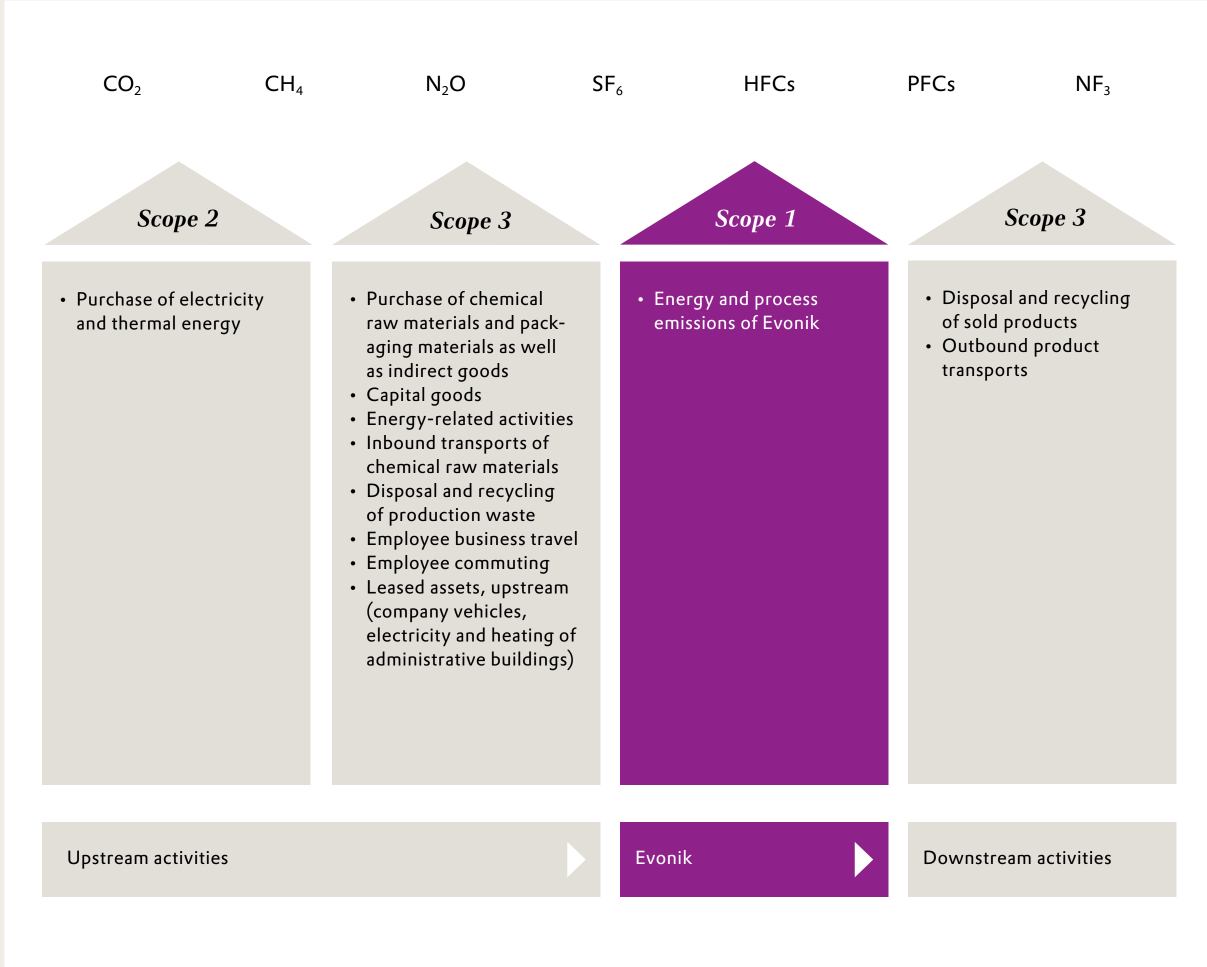
To ensure uniform environmental reporting, starting in 2020, the reporting of Evonik Carbon Footprint data was speed up ("fast close" process).

In this framework, data for some categories is collected quarterly. For other categories, data is compiled once a year on September 30 (the Q3 closing date) and for the remainder of the year, i.e. the fourth quarter, the emission amounts are estimated. Together with the respective experts, possible deviations from regular operations in the fourth quarter, seasonal effects and forecasts are taken into account. In the first quarter of the following year, calculations with actual Q4 data are performed and results are compared with the calculated data for the fast close report. Any discrepancies will be analyzed and measures to continuously improve the calculation methodology will be introduced as necessary.

2.3 OPERATIONAL BOUNDARIES

The calculation of the Evonik Carbon Footprint is based on the principles of the GHG Protocol, following the scope concept of operational boundaries[6] (see Figure 1).

FIGURE 1: Overview of areas covered for reporting greenhouse gas emissions along the value chain



[6] Refer to the GHG Protocol (http://www.ghgprotocol.org) for further details on the definition of principles and scopes.

Scope 1 covers direct energy- and process-related emissions of Evonik, while indirect emissions from purchased electricity and thermal energy for company use are combined in Scope 2, and those from other emission sources in Scope 3.

Scope 1 emissions from energy and production processes and Scope 2 emissions from secondary energy purchases were calculated using data from Evonik's "Sustainability Reporting (SuRe)" system. The SuRe system also contains more than 100 other environmentally relevant reporting items, as all the information required for Environment, Safety, Health, Quality (ESHQ) reporting – both regulatory- and sustainability-related – is collected within this system.

The greenhouse gas emission balance considers a net energy purchase figure (purchase of electricity and steam less sales of electricity and steam to third parties) using the market-based method. More detailed information concerning Scope 1 and 2 emissions is available in the Evonik Sustainability Report.

Evonik's Scope 3 data include emissions from the following categories:

- Category 1: Purchased chemical raw materials and packaging materials as well as indirect goods
- Category 2: Capital goods
- Category 3: Energy-related activities (outside of Scopes 1 & 2)
- Category 4: Inbound transports of chemical raw materials
- Category 5: Disposal and recycling of production waste
- Category 6: Employee business travel
- Category 7: Employee commuting
- Category 8: Leased assets, upstream (company vehicles, electricity and heating of administrative buildings)
- Category 9: Outbound product transports
- Category 12: Disposal and recycling of sold products

In accordance with the specifications of the WBCSD Scope 3 Chemical Sector Guidance, Category 10 (Processing of sold products) is not included in the balance. Due to the large number of products sold by Evonik, Category 11 (Use of sold products) is not part of the balance; in case of utilization by direct combustion (such as for fuel additives), the emissions are considered in Category 12 (Disposal of sold products). Emissions of Categories 13 to 15 (Leased assets downstream, Franchises, and Investments) are not reported. The calculations for greenhouse gas emissions described below do not include the setting up of infrastructure, such as roadbuilding or IT infrastructure.

The following specific calculation approaches, based partly on estimates and assumptions, were used to determine greenhouse gas emissions within the different categories:

CATEGORY 1:
PURCHASED CHEMICAL RAW MATERIALS AND PACKAGING MATERIALS AS WELL AS INDIRECT GOODS

In accordance with the WBCSD Scope 3 Chemical Sector Guidance, the emissions from extraction, production, and transports (except for the transports to Evonik reported in Category 4) of chemical raw materials and packaging materials, and from indirect goods were calculated in this category. Contrary to the WBCSD Scope 3 Chemical Sector Guidance, the calculation does not include emissions from services purchased.

Chemical raw materials:
We calculated the CO_2eq "backpack" based on a list of all purchased chemical raw materials provided by Evonik's procurement department. The 100 largest raw materials purchased in terms of mass were taken into account. An extrapolation of greenhouse gas emissions was carried out based on the quantities of raw materials. The 100 raw materials considered cover a significantly higher percentage of the total purchasing volume than the 80 percent coverage required by the WBCSD Scope 3 Chemical Sector Guidance.

With the help of the Sphera Solutions GmbH (formerly thinkstep AG), current emission factors from the GaBi 9 database (as of: 2020) were identified for the raw materials, which were used to calculate the carbon footprint, taking into account the quantities purchased. Where available, geographically representative datasets were used to determine emission factors, otherwise averages from several countries (e.g. global, EU) were used, and only in the last possible case country-specific individual datasets were applied. This approach served to minimize possible uncertainties with regard to regional differences in manufacturing processes and energy production. In addition, as of this year, supplier-specific emission factors were used for some purchased chemical raw materials. For substances whose emission factors could not be determined, values were estimated based on similar products (within the GaBi 9 database) or appropriate, average emission factors were used.

Indirect purchased goods and packaging materials:
Emissions from the production of indirect goods and packaging have been reported since 2014, whereby emissions from purchased services are not included in this category. A categorized compilation of procurement volumes of indirect purchases and packaging materials was used to calculate emissions related to the production of purchased goods, excluding chemical raw materials. These figures included both purchases of consumable goods and purchases of capital goods. Evonik's procurement department allocated the individual categories to the reported Categories 1 (purchased raw materials) and 2 (capital goods). Analogous to the evaluation of chemical raw materials, the top 100 categories were analyzed by purchasing volume. An extrapolation of greenhouse gas emissions was carried out based on volumes procured. The 100 categories considered meet the requirement of the WBCSD Scope 3 Chemical Sector Guidance to cover at least 80 percent of the total purchasing volume.

Based on the purchase values, the quantities of materials were determined using average prices. For these materials, current emission factors were identified from the GaBi 9 database (as of: 2020), which were then used to calculate the emissions from the production of the indirect goods.

CATEGORY 2:
CAPITAL GOODS

The calculation of emissions for capital goods is also based on data from indirect purchasing. The purchasing categories have been divided up in terms of capital goods and other indirect goods. The latter are reported in Category 1, while emissions for capital goods are reported in Category 2.

The top 100 categories were once again analyzed according to purchasing volume. An extrapolation of greenhouse gas emissions was performed on the basis of purchasing volumes. The 100 categories considered meet the requirement of the WBCSD Scope 3 Chemical Sector Guidance to cover at least 80 percent of the total purchasing volume. In accordance with the guidance, a breakdown into different materials per purchasing category was carried out.

Average prices for these materials were used to determine the quantities underlying the purchasing volumes. Current material-specific emission factors from the GaBi 9 database (as of: 2020) were then identified in order to calculate emissions associated with the production of capital goods.

CATEGORY 3:
ENERGY-RELATED ACTIVITIES (OUTSIDE OF SCOPES 1 & 2)

Category 3 reports emissions from the production of solid, liquid and gaseous energy sources used in the power plants operated by Evonik. These are not included in Scopes 1 & 2. The calculations are based on the produced energy quantities as recorded in the SuRe system. Emission factors from the GaBi 9 database (as of: 2020) were used to determine the greenhouse gas emissions related to the production of solid, liquid and gaseous energy sources.

CATEGORY 4:
INBOUND TRANSPORTS OF CHEMICAL RAW MATERIALS

Since Evonik does not have full knowledge of the transport distances and means of transport for incoming raw materials, an average emission factor per ton of transported product – calculated by using the data for outgoing transports – is applied to quantify emissions from incoming goods transports. This factor refers to the average distribution of different means of transport as well as distances of outgoing product transports of Evonik. The use of this average emission factor is based on the conservative assumption that the average means of transport and average distances can be applied to both Evonik's inbound and outbound transports. In order to ensure an up-to-date, consistent and regionalized assessment basis, geographically representative emission factors relevant for the means of transport used were identified from the current GaBi 9 database (as of: 2020). The transport emissions have been calculated for the extrapolated quantities of purchased raw materials (see Category 1).

CATEGORY 5:
DISPOSAL AND RECYCLING OF PRODUCTION WASTE

The emissions resulting from the disposal of production waste were calculated based on the waste quantities for each type of disposal as recorded in the SuRe system. The emission factors for the specific types of disposal were chosen analogously to those for the End-of-Life calculation in Category 12. The WBCSD Scope 3 Chemical Sector Guidance stipulates that waste that has been energetically recycled is to be accounted for in Scope 1. In Marl, for example, waste is energetically recycled in the hazardous waste incineration plant. Since the data basis does not permit separation of Evonik's internally and externally recycled waste, the emissions are included in full in Category 5, contrary to the requirements of the WBCSD Scope 3 Chemical Sector Guidance.
The calculation also includes emissions from the disposal of construction and demolition waste.

CATEGORY 6:
EMPLOYEE BUSINESS TRAVEL

The CO_2eq emissions generated by business trips were calculated based on the travel distances provided by Evonik Travel Management using the corresponding emission factors of the means of transport used. Emission factors take fuel supply into account and were adopted from publications of the UK Department for Business, Energy & Industrial Strategy (BEIS).[7] The calculation of greenhouse gas emissions was carried out for employees in Germany (constituting approx. 60 percent of employees worldwide) and extrapolated based on the number of employees worldwide.

CATEGORY 7:
EMPLOYEE COMMUTING

Emissions caused by employee commuting were calculated conservatively, taking into account the recommendations in the WBCSD Scope 3 Chemical Sector Guidance. In previous years, it was assumed that all Evonik employees commute a distance of 60 km (30 km per route) with their own private car on 220 working days. Due to the COVID-19 pandemic and the thereby intensified necessity to work from home, assumptions for 2020 were adjusted: 25 percent of the employees work 50 percent of their working days from home. This estimation is based on the number of employees that are employed in areas where mobile working is generally possible. The average number of working days for commuting is thus reduced to 196. The emission factor per passenger kilometer was taken from BEIS data[7] and takes fuel supply into account.

CATEGORY 8:
LEASED ASSETS, UPSTREAM

COMPANY CARS
(EXCLUDING UTILITY VEHICLES):
The CO_2eq emissions related to Evonik's company cars were calculated by using the average number of kilometers driven, the number of company vehicles, the manufacturer's CO_2eq emissions data, and considering additional emissions for fuel supply and for the production of the cars. The calculation was carried out for the employees in Germany and extrapolated using the number of employees worldwide.

ELECTRICITY AND HEATING REQUIREMENTS
OF ADMINISTRATIVE BUILDINGS:
CO_2eq emissions caused by power and heating requirements of administrative buildings are included in the SuRe system and thus already covered in Scope 1 and Scope 2 emissions, provided that a production

[7] UK Department for Business, Energy & Industrial Strategy (BEIS): Greenhouse gas reporting: Conversion factors 2020 (https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020)

plant subject to official CO_2eq reporting is located at the site. The greenhouse gas emissions of purely administrative locations were determined on the basis of average electricity and heating requirements per employee, which were surveyed at a number of key administrative locations. The total CO_2eq emissions in this category were thus determined based on the number of Evonik employees at administrative sites.

CATEGORY 9:
OUTBOUND PRODUCT TRANSPORTS

As described in Category 4, the CO_2eq emissions of outgoing transports of chemical products were computed by using regionalized, transport-specific emission factors from the current GaBi database (Version 9). Calculations are based on the goods issue quantities, the average transport distances and the type of selected means of transport as provided by logistics procurement.

CATEGORY 12:
DISPOSAL AND RECYCLING OF SOLD PRODUCTS

Emissions resulting from the disposal and recycling of Evonik products were determined using the following calculation steps: Since Evonik is often unaware of the end uses of its own products – especially intermediates – the emissions resulting from their disposal were not calculated for the applications themselves, but only for the Evonik products contained therein. Thus, only the emissions associated with the disposal of product quantities sold by Evonik were collected and not those of the end products manufactured from them with the help of third-party raw materials. The CO_2eq emissions were calculated using emission factors for the following types of disposal:

- recycling,
- sealed and open landfills, and
- incineration with and without energy recovery.

For each disposal type, continent-specific percentage averages of the respective disposal type shares were determined and weighted with the relative shares of all products sold by Evonik per continent in 2020.

The CO_2eq emissions for disposal were calculated using the sales volumes per product line and the corresponding emission factors. For product lines whose products are obviously not recycled via the usual disposal channels, specific calculations were made in accordance with the recommendations of the WBCSD Scope 3 Chemical Sector Guidance. For example, emissions from the incineration of certain products have been calculated based on stoichiometric ratios, while those from inert products have been computed via another approach.

3

Results

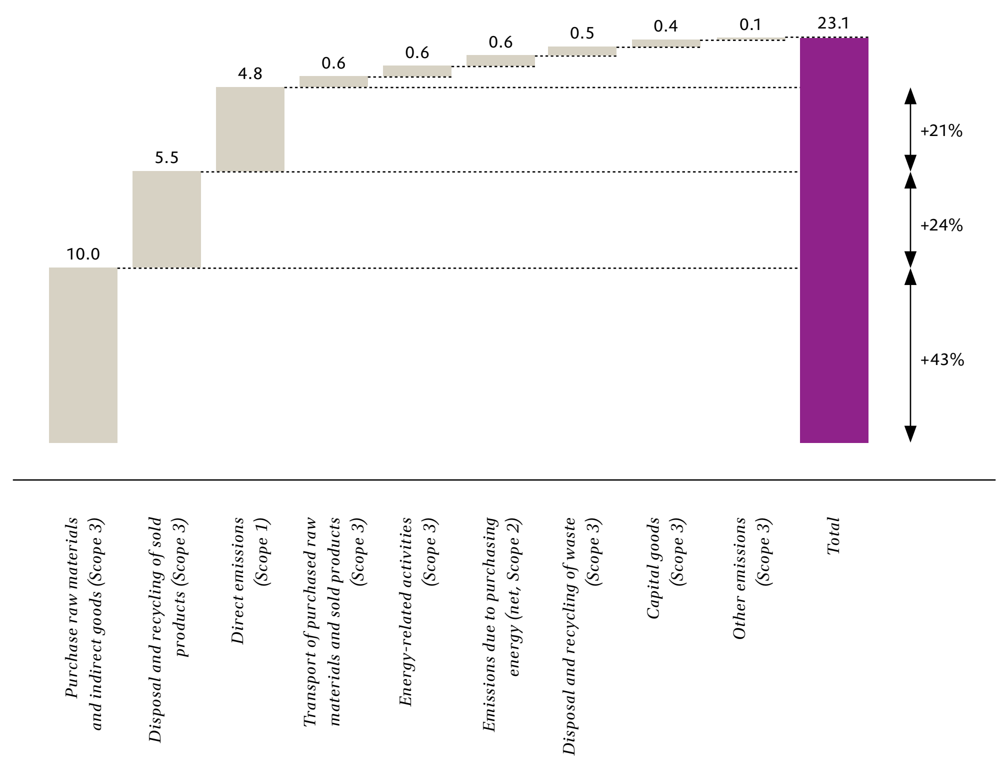
Evonik's CO_2eq emissions along the value chain amounted to 23.1 million tons of CO_2eq in 2020 (see Table 3). The highest proportion of emissions is attributable to the purchase of chemical raw materials and packaging materials as well as indirect goods, followed by emissions from disposal in Scope 3 and direct emissions in Scope 1 (see Figure 2).

The development of individual categories from 2016 to 2020 is shown in Table 4. In 2017, a rise in greenhouse gas emissions compared to the previous year becomes evident. Higher sales amounts are reflected in an increase in emissions in Category 1. Emissions in Category 12, on the other hand, decrease marginally due to a slight shift in product-specific sales volumes. An increase in sales was also recorded for 2018, although this did not apply equally to all products. The product-specific increase in sales led in particular to an increase in CO_2eq emissions related to the purchase of raw materials (Category 1); the other categories were only affected to a small extent. The significant decrease in greenhouse gas emissions in 2019 is mainly due to the sale of the methacrylates business. Reduced emission levels have been recorded for almost all categories. The increase in Category 7 (Employee commuting) is due to the fact that, unlike in previous years, the emission factors for passenger transport used this year also consider fuel supply. These increased factors cause a higher volume of greenhouse gas emissions despite the smaller total number of employees. In 2020, the amount of greenhouse gas emissions decreases slightly. Changes in emission volumes in the individual categories result, among other things, from the impact of the COVID-19 pandemic and the acquisition of PeroxyChem. While most categories remained at around the same level, lower sales volumes lead to a reduction in emissions in category 12 "Disposal and recycling of sold products". Moreover, methodological refinements occurred. In particular, category 1 "Purchased chemical raw materials and packaging materials as well as indirect goods" is affected by the integration of supplies purchased for resale as well as the inclusion of supplier-specific information.

TABLE 3: Trend in greenhouse gas emissions along the value chain of Evonik Industries (excluding the use phase)

	2016	*2017*	*2018*	*2019*	*2020*
CO_2eq emissions in millions of metric tons	25.9	26.9	27.5	23.3[8]	**23.1**

FIGURE 2: Evonik Carbon Footprint 2020 (excluding the use phase) [in millions of metric tons CO_2eq]



Differences in totals due to rounding.

8 Corrected value. For more details, see footnotes 9 and 10 on page 19.

TABLE 4: Trends in greenhouse gas emissions in the individual categories along the value chain of Evonik Industries (excluding the use phase)

in millions of metric tons CO_2eq	*2016*	*2017*	*2018*	*2019*	*2020*
Production facilities of Evonik (Scope 1)	5.4	5.6	5.7	4.9	**4.8**
Purchased energy (net, balance of purchased electricity and steam less sales of electricity and steam to third parties; market-based approach) (Scope 2)	1.0	0.9	0.9	0.6	**0.6**
Category 1: Purchased chemical raw materials and packaging materials as well as indirect goods (Scope 3)	10.3	11.1	11.5	9.6[9]	**10.0**
Category 2: Capital goods (Scope 3)	0.6	0.5	0.6	0.4	**0.4**
Category 3: Energy-related activities (outside of Scopes 1 & 2) (Scope 3)	0.6	0.6	0.7	0.6	**0.6**
Category 4: Inbound transports of chemical raw materials (Scope 3)	0.4	0.4	0.4	0.3[9]	**0.3**
Category 5: Disposal and recycling of waste generated in operations (Scope 3)	0.5	0.5	0.5	0.5[10]	**0.5**
Category 6: Employee business travel (Scope 3)	0.04	0.04	0.04	0.03	**0.01**
Category 7: Employee commuting (Scope 3)	0.1	0.1	0.09	0.1	**0.08**
Category 8: Leased assets, upstream (company vehicles, electricity and heating of administrative buildings) (Scope 3)	0.02	0.03	0.03	0.02	**0.02**
Category 9: Outbound product transports (Scope 3)	0.4	0.5	0.5	0.3	**0.3**
Category 12: Disposal and recycling of sold products (Scope 3)	6.6	6.5	6.6	5.9	**5.5**
TOTAL	**25.9**	**26.9**	**27.5**	**23.3[9]**	**23.1**

Differences in totals due to rounding.

9 Data corrected due to improved availability of data on purchased amounts, which were not available until after publication of the 2019 findings. This correction affects Categories 1 and 4 as well as the total result.

10 Data corrected due to improved availability of reference data on waste amounts for 2019. These were adjusted to smaller values retrospectively (cf. Evonik Sustainability Report 2020). This correction of reference data does not become apparent from the aggregated emission value for Category 5 compared to the initially published value for 2019.


REDUCTIONS
IN GREENHOUSE
GAS EMISSIONS
BY THE USE
OF EVONIK
PRODUCTS

1

Summary and results

32 **million tons CO_2eq**

avoided greenhouse gas emissions over the application life cycle of selected Evonik products sold in 2020

Evonik offers numerous products that – compared with conventional alternatives – make a positive contribution to reducing greenhouse gas emissions in their applications. This section presents certain selected "beacon" products that enable greenhouse gas emissions savings compared to their established alternatives.

The reductions listed here are generated by the applications of the following four products: "green tire" technology, amino acids in animal feed, foam stabilizers for insulating materials, and additives for hydraulic fluids. Savings were generated over the life cycle of the applications that were manufactured with the product volumes sold by Evonik in the specified year.

Unless otherwise specified, the data has been compiled since 2013 using the methodology recommended for reporting avoided emissions in the guidance jointly published by the World Business Council for Sustainable Development (WBCSD) and the International Council of Chemical Associations (ICCA) in October 2013 (hereinafter "WBCSD Avoided Emissions Guidance"). In 2017, the guidelines were updated and a second edition published.[11] The WBCSD Avoided Emissions Guidance was developed with the participation of a number of globally active chemical corporations and represents a first international, multi-company agreement on the recording of avoided greenhouse gas emissions of products and their applications. Evonik was also an active participant in the development of the WBCSD Avoided Emissions Guidance.

The criteria for including beacon products in the portfolio of emission-saving products of Evonik closely follow the criteria listed in the WBCSD Avoided Emissions Guidance for selecting a reference product. Both the emission-saving product and the reference product must deliver the same function to the user and be used in the same application. Additionally, the reference solution must be available on the market, interchangeable for the typical customer on the selected market, and as similar as possible to the emission-saving product in terms of data quality, methodology, and assumptions.

The WBCSD Avoided Emissions Guidance recommends reporting the calculated savings associated with the selected application in its entire value chain. In 2020, the use of the four Evonik products resulted in the avoidance of 32 million metric tons CO_2eq. These 32 million metric tons CO_2eq reflect the total savings of the selected applications that were enabled by the amounts of the four Evonik solutions sold in 2020. The contribution of the individual products are described in qualitative terms (see Appendix), using the significance categories listed in Table 5.

Evonik did not publish any data on avoided emissions in 2019. To take market developments into account, this break in reporting was used to adapt the data basis and the calculation methodology for the products and system solutions outlined above, based on the results of our sustainability analysis. This included reviewing and modifying the respective reference system and the scope of the Evonik products examined. This updated assumptions concerning the reference solutions led to a sharp drop compared to the total savings of 108 million metric tons CO_2eq reported in 2018.

In the course of the revision, more methodological refinements in calculating avoided greenhouse gas emissions were made. For example, for amino acids for animal nutrition the functional unit has been altered to 1 metric ton live weight, along with a more regional perspective. For additives for hydraulic fluids, the changes included altering the functional unit from 2,000 h operation to 1 million metric tons mass moved and greater differentiation by applications. More detailed information is described on the following pages.

These CO_2eq savings are not directly comparable with the Evonik Carbon Footprint, because that refers to emissions associated with the manufacture of Evonik products (generally intermediates) and includes both production and supply chain emissions as well as emissions arising from disposal, excluding the use phase. By contrast, the CO_2eq savings have been calculated on the basis of the life cycle emissions of applications of selected Evonik products.

[11] World Business Council for Sustainable Development (WBCSD) and International Council of Chemical Associations (ICCA), Avoiding Greenhouse Gas Emissions-Guidelines: Accounting for and Reporting Greenhouse Gas (GHG) Emissions Avoided along the Value Chain based on Comparative Studies, Version 2, December 2017

Methodology

Life cycle emissions are typically calculated in Life Cycle Assessments (LCAs) in accordance with DIN ISO 14040 ff. The WBCSD Avoided Emissions Guidance specifies that comparative LCAs should be used to calculate reductions in greenhouse gas emission. However, because LCAs are very time- and resource-intensive, they are not generated for all Evonik products. If, therefore, no LCA is available for the application of a beacon product, emissions and reductions are calculated using the externally tested Carbon Footprint Estimation (CFE) method, primarily on the basis of emission factors from the GaBi LCA software (Sphera Solutions GmbH) used by Evonik.

Evonik developed the CFE model as a method for evaluating early project and research ideas in terms of their greenhouse effects as well as for calculating CO_2eq emissions and savings of products or processes. The methodology of a CFE resembles that of an LCA with some simplifications. In contrast to a full LCA, however, the CFE focuses only on the greenhouse effects of products and processes.

The Simplified Calculation Methodology mentioned in the WBCSD Avoided Emissions Guidance was used for the savings calculation based on comparative LCAs as well as for comparisons based on CFEs. This simplified method specifies that identical parts in the reference and Evonik solutions be excluded from consideration because they do not affect the calculation of saved greenhouse gas emissions. To give an example, the calculation of avoided greenhouse gas emissions for green tire technology did not take account of the entire vehicle over its value chain, but considered only the savings from the use of the silica-silane reinforcement system and synthetic rubber (styrene butadiene and polybutadiene rubber) in a car tire over 150,000 km. This approach has no impact on the ultimate amount of the calculated greenhouse gas reductions. The section below gives further details of the calculation method in the context of the respective reduction projects.

Figure 3 shows an illustration of greenhouse gas emissions and reductions for the reference and Evonik solutions, based on the WBCSD Avoided Emissions Guidance.

GREENHOUSE GAS REDUCTIONS ARE CALCULATED IN ACCORDANCE WITH THE WBCSD AVOIDED EMISSIONS GUIDANCE FOR THE FOLLOWING COMPARATIVE CATEGORIES:

- Category 1, in which the reference solution is equivalent to non-use of a product
- Category 2, in which the reference solution originates from another sector of industry
- Category 3, in which the reference solution also originates from the chemical industry

FIGURE 3: Illustration of CO_2eq emissions and reductions for the reference and Evonik solutions (based on the WBCSD Avoided Emissions Guidance, p. 9)

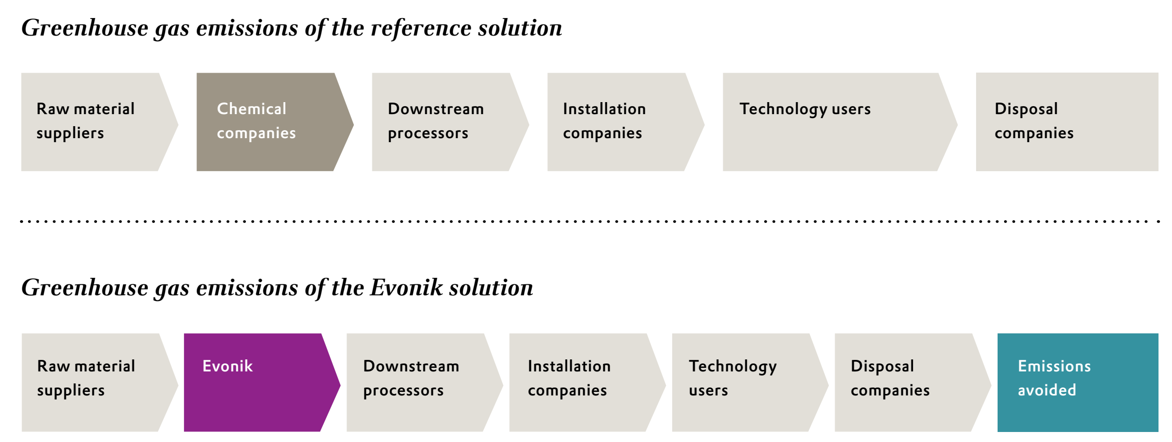


TABLE 5: Significance of the contribution of a chemical product to saving emissions in the value chain, based on its functioning (based on the WBCSD Avoided Emissions Guidance, p. 25)

Significance of contribution	*Relationship between chemical product and application*
Fundamental	The chemical product is the key component that allows savings in GHG emissions in the first place.
Extensive	The chemical product is part of the key component and its properties and functions are necessary to effect savings in GHG emissions.
Substantial	The chemical product does not directly contribute toward savings in GHG emissions, but cannot be easily replaced without changing the GHG emission-saving effect of the solution.
Low	The chemical product does not contribute directly to saving GHG emissions, but is used in the manufacturing process of a product with a fundamental or extensive GHG saving effect.
Too small to communicate	The chemical product can be substituted without changing the GHG emission-saving effect of the solution.

THE FOLLOWING CRITERIA LISTED IN THE WBCSD AVOIDED EMISSIONS GUIDANCE APPLY TO THE REFERENCE SOLUTION:

- The reference application serves the same purpose.
- The reference application is used in the same application.
- The reference application is available on the selected market.
- The reference application is interchangeable for the typical user in terms of quality criteria.
- The reference application is as close a match as possible to the Evonik solution.

In accordance with the WBCSD Avoided Emissions Guidance, the results of the reduction calculations are indicated for the value chain of the entire application, because the contribution of a single product to all savings in the value chain is usually difficult to quantify and can therefore be based on assumptions. Table 5 shows the qualitative description of the contributions made by individual products.

Contrary to the specifications of WBCSD Avoided Emissions Guidance, greenhouse gas reductions are not displayed individually for each application of an Evonik product but as an aggregated figure for Evonik.

THE APPROACH DESCRIBED ABOVE TO CALCULATE CO_2EQ EMISSIONS AND REDUCTIONS IS SUBJECT TO CERTAIN LIMITATIONS:

- Infrastructure measures such as construction of facilities, machinery, and roads, and IT infrastructure are not included.
- Due to the large number of applications of Evonik products, the carbon footprint was calculated only for specific beacon applications that were identified in a screening process. Evonik does not claim to have a complete data inventory on the CO_2eq emissions and savings of all its product applications.
- Evonik is aware that the CFEs performed are not comparative LCAs with an external review panel as defined in DIN ISO 14040 ff.

2.1 REDUCTIONS IN GREENHOUSE GAS EMISSIONS FROM GREEN TIRE TECHNOLOGY

HOW DOES THE TECHNOLOGY REDUCE GREENHOUSE GAS EMISSIONS?

Compared to conventional car tires, the use of the silica-silane-system and a certain polymer blend (solution styrene butadiene rubber (S-SBR) and butadiene rubber (BR)) – known as green tire technology – can achieve significant fuel savings and improved wet grip without impacting abrasion resistance (see Figure 4). The lower fuel consumption results in end-users generating fewer CO_2eq emissions.

BACKGROUND

The rubber compounds in tires have a major impact on the characteristics of tire performance. Organic and inorganic components determine the performance of the tread compound that is in contact with the road surface. Such treads typically contain about 35 percent reinforcing filler, without which rubber compounds could not attain the desired properties such as traction, abrasion resistance, tear resistance, and tear propagation resistance. For decades, these properties could only be achieved with customized carbon blacks.

Today, the replacement of carbon black with silica offers even further improvements in car tires. Due to the different chemical properties of rubber and silica, however, these components are not capable of bonding. This is where bifunctional organic silicon compounds – or organosilanes – come in: They serve as coupling agents that bond the silica and rubber in the manner of a bridge.

Key characteristics such as rolling resistance, wet traction, and abrasion resistance can generally be optimized only to a limited extent, and with negative impact on other properties. In contrast to conventional carbon black filler systems, the use of the silica-silane system allowed for the first time an expansion of the "magic triangle" of tire performance (see Figure 5). Rolling resistance and wet traction were improved without significantly affecting abrasion, and therefore the service life, of the tire. These improvements have resulted in significantly lower fuel consumption for end-users, and therefore in reduced CO_2eq emissions.

Please refer to the Appendix for further information on the methodology, the selection of audit parameters, and other reporting elements in accordance with the WBCSD Avoided Emissions Guidance.

FIGURE 4: Braking characteristics and fuel consumption

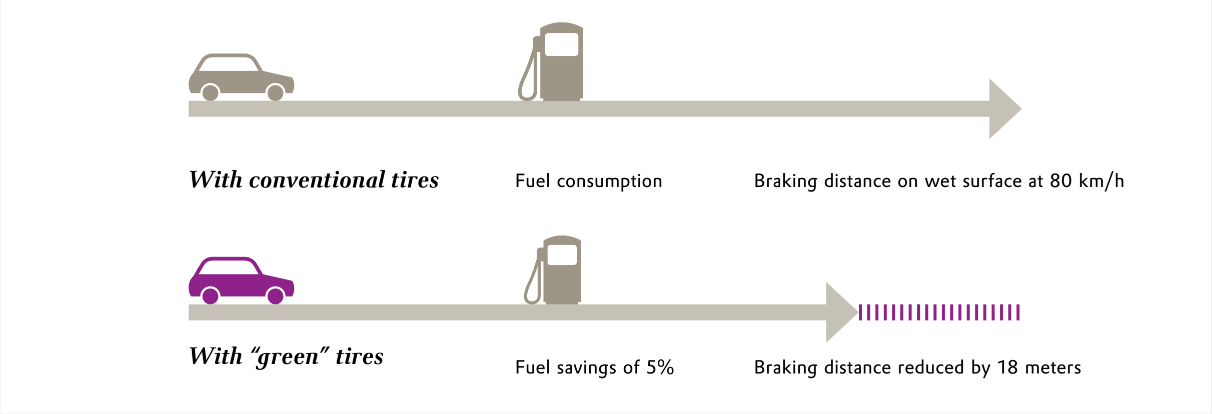
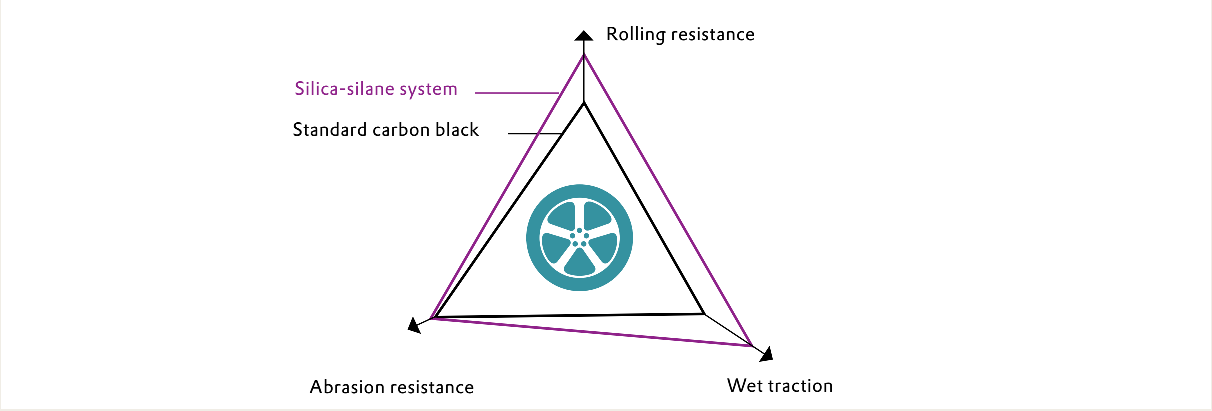


FIGURE 5: Expansion of the "magic triangle" by the silica-silane system



2.2 REDUCTIONS IN GREENHOUSE GAS EMISSIONS FROM AMINO ACIDS IN ANIMAL FEED

HOW DOES THE TECHNOLOGY REDUCE GREENHOUSE GAS EMISSIONS?

Animal feed is specifically formulated to meet the physiological and nutritional needs of the animals, and in particular the necessary requirements of essential amino acids. Lack of certain amino acids in animal feed can be compensated either by adding a higher percentage of protein-rich feed components such as oil seed, or by fortifying the feed with essential amino acids. Supplementing animal feed with essential amino acids can save significant amounts of feed raw materials, resulting in the freeing up of required land and water resources, and a corresponding reduction in CO_2eq emissions. Furthermore, feed supplementation with these essential amino acids reduces emissions of both nitrogen and greenhouse gases resulting from feeding and excretion, and offers credits for the use of natural manure.

BACKGROUND

MetAMINO® is an example of an amino acid containing sulfur. Unlike several other amino acids, it cannot be generated in the animal's own body. Methionine is particularly important in poultry nutrition because of a higher demand for this protein-forming amino acid for feather growth.

Evonik manufactures **MetAMINO®** in a chemical process called the carbonate process. The company produces many of the important intermediates, such as acrolein, methyl mercaptan, and hydrocyanic acid, in an integrated production process at the same site. The reaction steps are integrated in various circuits and byproducts and intermediates as well as energy streams can be used by other plants at the same site.

Biolys® is the Evonik-specific brand of L-lysine (L-α, ε-diamino-n-caproic acid). It is an essential amino acid contained in almost all proteins, and because of its basic side chain is classified as a basic amino acid. L-lysine is the first limiting essential amino acid in hog farming.

In contrast to MetAMINO®, **Biolys®** – like all the other amino acids described here – is produced by biotechnological fermentation processes using microorganisms. As a consequence, these amino acids are automatically obtained as the L enantiomer, which is the only biologically effective form. Evonik's commercial L-lysine trade product is Biolys®, which contains L-lysine sulfate and biomass resulting from fermentation as an additional component. The active ingredient content is at least 54.6% L-lysine.

ThreAMINO® (L-threonine or L-α- amino-β-hydroxybutyric acid) is a neutral essential amino acid.

Alongside methionine and lysine in poultry farming and lysine and methionine in hog farming, threonine is the next limiting essential amino acid.

TRYPAMINO® (L-tryptophan or L-2-amino-3-(3'-indolyl)propionic acid) is among the structurally more complex aromatic amino acids.

Tryptophan is the next limiting amino acid after threonine in hog farming.

ValAMINO® (L-valine or L-2-amino-3-methylbutanoic acid) is an amino acid with a structure relatively similar to that of ThreAMINO®. In both poultry and hog farming valine is the next limiting amino acid after tryptophan.

ThreAMINO®, TrypAMINO® and **ValAMINO®** are produced by a biotechnological method.

Please refer to the Appendix for further information on the methodology, the selection of audit parameters, and other reporting elements in accordance with the WBCSD Avoided Emissions Guidance.

2.3 REDUCTIONS IN GREENHOUSE GAS EMISSIONS FROM IMPROVED INSULATION MATERIALS

HOW DOES THE TECHNOLOGY REDUCE GREENHOUSE GAS EMISSIONS?

Evonik develops additives, specifically foam stabilizers (TEGOSTAB®), which are very important in foam production and for optimizing foam properties. These polyurethane (PU)-based foams are used, for example, in building insulation or for insulating electrical appliances such as refrigerators. The improvement of insulation properties reduces energy consumption and thus helps reduce greenhouse gas emissions.

BACKGROUND

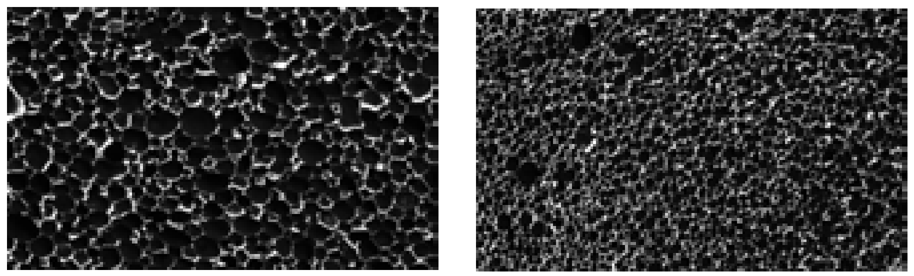
The stabilizers used for the production of polyurethane foam consist of polyether-modified polysiloxanes. In these surface-active substances, the siloxane chain represents the hydrophobic part of the molecule that is located at the surface of the foam cells; this lowers the surface tension and thereby stabilizes the foam. The polyether groups, as the hydrophilic part of the molecule, are responsible for compatibilization with the PU matrix, which makes the surface activity possible.

To achieve maximum foam stabilization and the particularly fine-cell foam structure resulting from this, the molecular structure has to be adapted to the individual foam formulation. Custom-tailored foam stabilizers therefore give rise to particularly good insulating properties in the finished foam product.

In addition to improving the fine-cell structure of foam, customized foam stabilizers also serve to optimize the processing properties of a foam system. They minimize irregularities such as cavities (undesirable hollow spaces) in the foam and help achieve a more homogeneous density distribution, which also contributes to a further improvement of insulating properties.

Please refer to the Appendix for further information on the methodology, the selection of audit parameters, and other reporting elements in accordance with the WBCSD Avoided Emissions Guidance.

FIGURE 6: Micrographs of the cell structure of foam systems with standard additives and with additives from Evonik



Micrographs illustrate the positive effect of optimized Evonik foam stabilizers on the fine-cell structure of rigid polyurethane foams. The top image is a micrograph of the cell structure of a modern foam system for refrigerator insulation; the bottom image shows (at the same magnification) foam containing the same polyurethane system, in which the standard additives have been replaced by the Evonik additives. The finer the cell structure of the foam, the lower the thermal radiation it can transmit, which results in a lower overall thermal conductivity.

2.4 REDUCTIONS IN GREENHOUSE GAS EMISSIONS FROM IMPROVED HYDRAULIC OILS

HOW DOES THE TECHNOLOGY REDUCE GREENHOUSE GAS EMISSIONS?

Mobile construction machines consume the bulk of their required energy in their hydraulic units. Using DYNAVIS® technology enables significant fuel savings and productivity gains compared to conventional hydraulic oils that are mostly monograde fluids or oils with low additives content (Figure 7). Lower fuel consumption means that end users generate fewer greenhouse gases (CO_2eq), especially carbon dioxide.

BACKGROUND

The hydraulic fluid plays a major role in the use of hydraulic construction machinery such as excavators and wheel loaders. Its viscosity and viscosity-temperature behavior has a considerable impact on the operation of such hydraulic machinery (Figure 8). Evonik's oil additive specialists have performed studies with hydraulic excavators of different sizes in day-to-day operations in various applications as well as field tests following a defined protocol that reflects the typical work modes of such machinery.

The viscosity of a hydraulic fluid decreases with increasing temperature. This dependency can be minimized with DYNAVIS® technology, based on fluid formulations with viscosity index improvers of high shear stability, which allows for energy savings.

At low temperatures, such thinner oils reduce internal friction and enable an easier cold start and warm-up phase. At high temperatures, a more viscous oil prevents an increase in internal return flow losses in the hydraulic pumps, thereby increasing volumetric efficiency. This ensures that the viscosity does not fall below a prescribed minimum, thus ruling out overheating, increased wear, and premature failure. For end users these improvements result in significantly higher productivity and lower fuel consumption, and therefore in reduced CO_2eq emissions.

Please refer to the Appendix for further information on the methodology, the selection of audit parameters, and other reporting elements in accordance with the WBCSD Avoided Emissions Guidance.

FIGURE 7: Comparison of monograde and DYNAVIS® hydraulic fluids and effects on the application

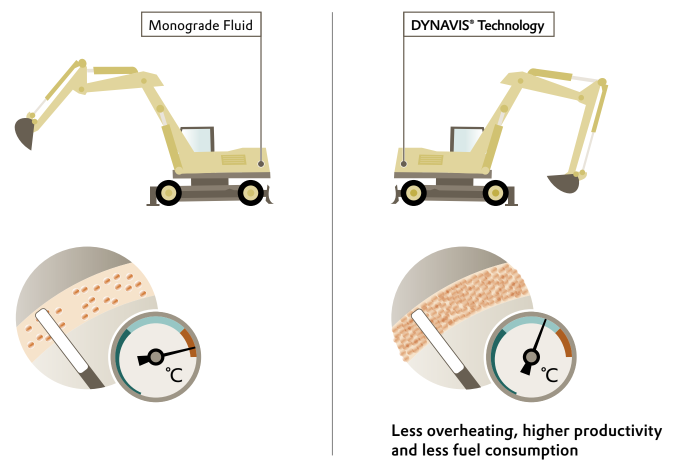
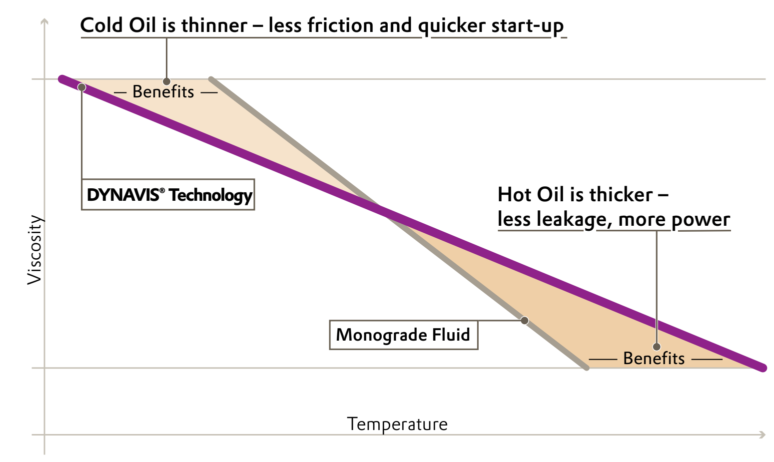


FIGURE 8: Dependence of viscosity on temperature, and positive effects on the application

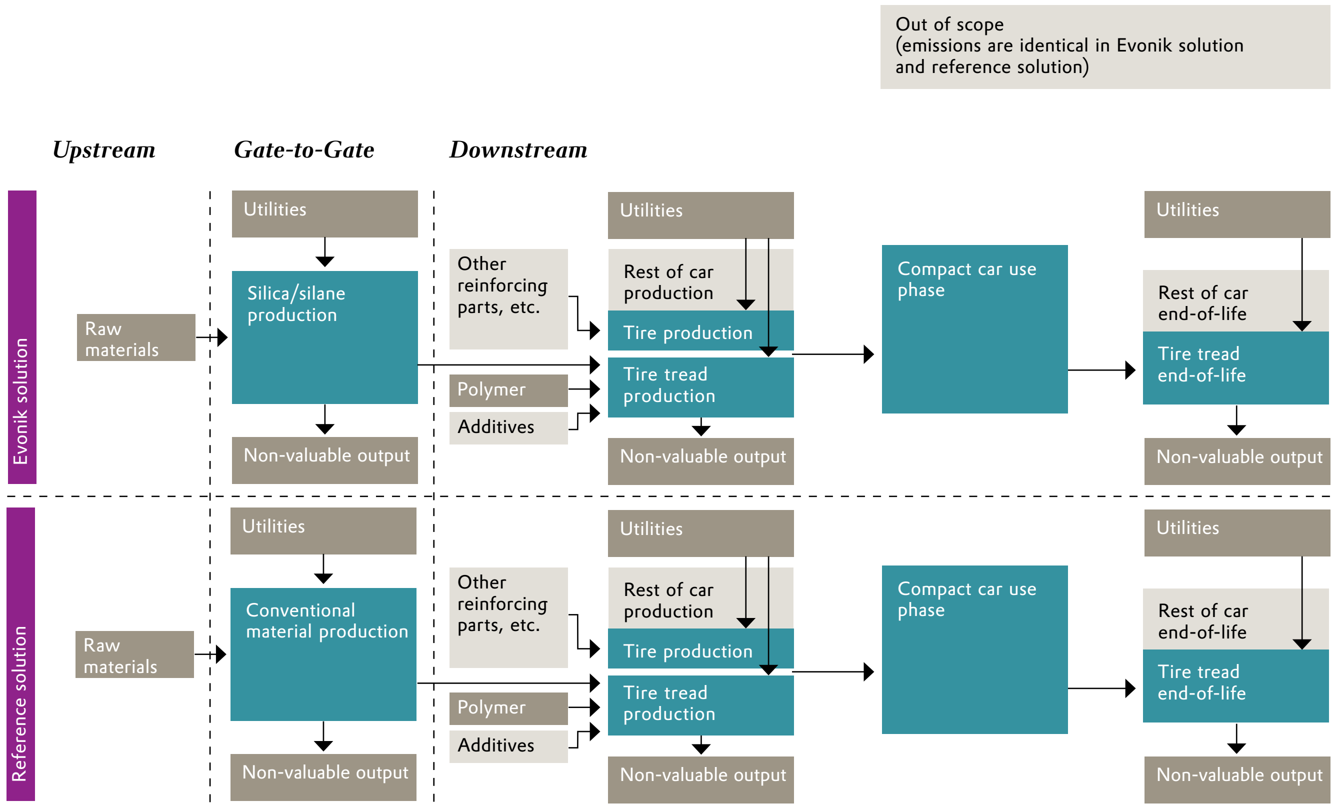


APPENDIX

Reductions in greenhouse gas emissions from green tire technology

Objective of the study	Calculation of greenhouse gas emissions avoided by the use of a silica-silane system in a specific rubber blend (S-SBR, BR) (green tire) as a tread component, as compared with the use of carbon black and emulsion styrene butadiene rubber (E-SBR) (carbon black tire), in a compact car tire over 150,000 km.
Type of comparison	Category 3 (chemical product vs. chemical product/technology)
Reference solution	Carbon black as filler material and E-SBR as tread component. Both the “green tire” and the tire with conventional tread fulfill the same function, are at the same level of the value chain, are used in the same application, and are interchangeable for a typical customer as commercially available solutions.
Functional unit	The use of silica-silane and rubber compound (S-SBR, BR) (Evonik's solution) or carbon black and E-SBR (reference solution) as components in a compact car tire over 150,000 km (“cradle to grave”).
Temporal and geographical reference	The life cycle assessment including the external panel review was completed in 2016. The production data utilized refer to the year 2014 and to sites in Germany and Belgium. An update of some timely varying datasets occurred in 2020. Sales volumes of Evonik silica and silanes for 2020 were used to calculate overall savings.
Calculation method	To determine savings in greenhouse gas emissions, the internal Evonik Life Cycle Management team, working in close cooperation with experts from the responsible business lines, performed a Life Cycle Assessment (LCA) in 2015 in accordance with the requirements of DIN ISO 14040 ff. As part of the LCA, the green tire and the conventional carbon black tire were compared over their entire life cycle. To take the use phase into consideration, the required volume of tread components was included in the accounting for the distance of 150,000 km, and the differences in fuel consumption and the associated greenhouse gas emissions were calculated for both systems. For reasons of simplicity, identical emissions (for example, those associated with the manufacture and disposal of the rest of the vehicle) were not taken into account. This approach had no impact on the amount of savings. The greenhouse gas emissions are calculated from the sum of the emissions arising during production of the respective systems as well as the emissions generated during the use phase and in the end-of-life phase. The difference between the green tire and the carbon black tire ultimately shows the savings in greenhouse gas emissions.
Significance of the contribution of the Evonik product to overall reductions in the application	The calculated reductions refer to the entire value chain of the selected application. Evonik silica and silanes are however part of the key components and their properties and functions are necessary and responsible for achieving reductions in greenhouse gas emissions. Green tire technology therefore makes an extensive contribution to reducing greenhouse gas emissions.
References	A detailed list of the referenced literature is available from Evonik on request.
Supplementary notes	The life cycle assessment was externally reviewed and certified as part of a panel review. No scenario analyses for future developments were performed. Allocation of the avoided emissions to companies involved in the value chain was not performed due to the extensive contribution of the Evonik products to green tire technology.

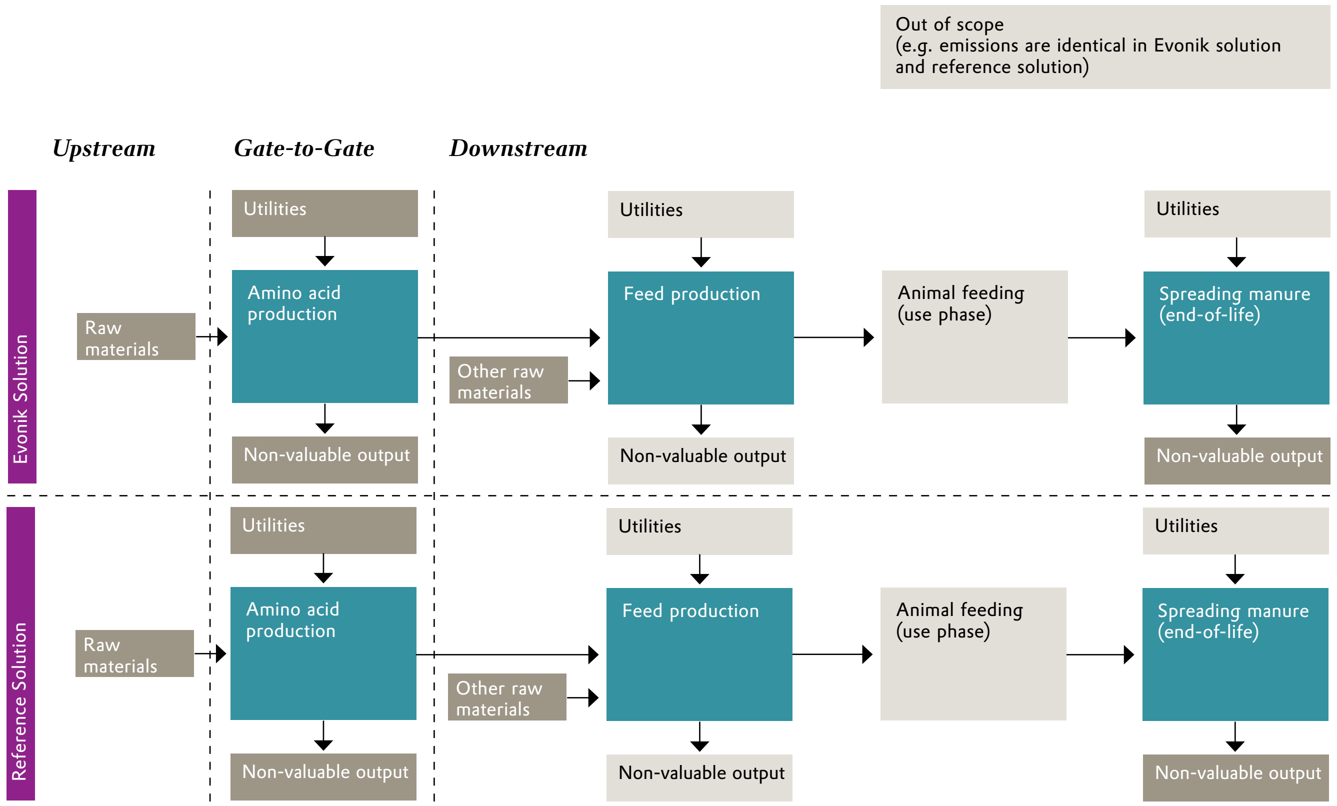
FIGURE 9: Overview of audit parameters for calculating reductions in greenhouse gas emissions from green tires



Reductions in greenhouse gas emissions from amino acids in animal feed

Objective of the study	Calculation of greenhouse gas emissions avoided by the use of amino acids in low-protein animal feed as recommended by Evonik, compared to a level and composition of amino acid supplementation customary in the market.
Type of comparison	Category 3 (chemical product vs. chemical product/technology)
Reference solution	The Life Cycle Assessment compared two options: • Feed mix with a balanced amino acid profile based on Evonik recommendations, representing "best practice" for diets with low protein levels • Feed mix with an amino acid supplementation customary in the regional market. Such a feed mix usually contains less and a different amino acid supplementation. All mixes fulfill the same function, are at the same level of the value chain, are used in the same application, and are interchangeable for a typical customer as commercially available solutions.
Functional unit	The functional unit and the reference flow were defined as 1 ton live weight or, in the case of feeding laying hens, 1 ton eggs.
Temporal and geographical reference	The composition of the feed mixes and the animals' nutritional demands per functional unit relates to the year 2019. Feeding of pigs, broilers and laying hens was covered by the study. The composition of the feed mixes, the animals' nutrional demand and (as far as possible concerning data availability) the regional origin of feed materials was adapted to the regions Europe, North America, South America, North Asia and South Asia, respectively. The global sales volumes for amino acids supplied by Evonik to the feed industry in 2020 were used to calculate total savings.
Calculation method	To determine the reductions in greenhouse gas emissions, the internal Evonik Life Cycle Management team conducted a Life Cycle Assessment (LCA) in close cooperation with the Business Line Animal Nutrition in 2020. Accounting for the individual scenarios with reference to the corresponding specific feed mixes is always in accordance with the "cradle to grave" principle, i.e., from the provision of raw materials for the individually added amino acids, through agricultural cultivation of feed raw materials, production of mineral fertilizers for agricultural production, expenditures for harvesting, intermediate processing of agricultural r aw materials, and all transport-related expenditures for all utilized raw materials, intermediates, and end products in technical terms, to emissions associated with feeding and excretion.
Significance of the contribution of the Evonik product to the total reductions for the application	The calculated reductions refer to the entire value chain of the selected application. The amino acid supplementation recommended by Evonik enables "best practice" low-protein animal feed and has thus together with the amino acids sold by Evonik a fundamental contribution to the savings.
References	A detailed list of the referenced literature is available from Evonik on request.
Supplementary notes	No scenario analyses for future developments were performed. Allocation of avoided emissions to the companies involved in the value chain was not performed due to the fundamental contribution of Evonik's amino acids.

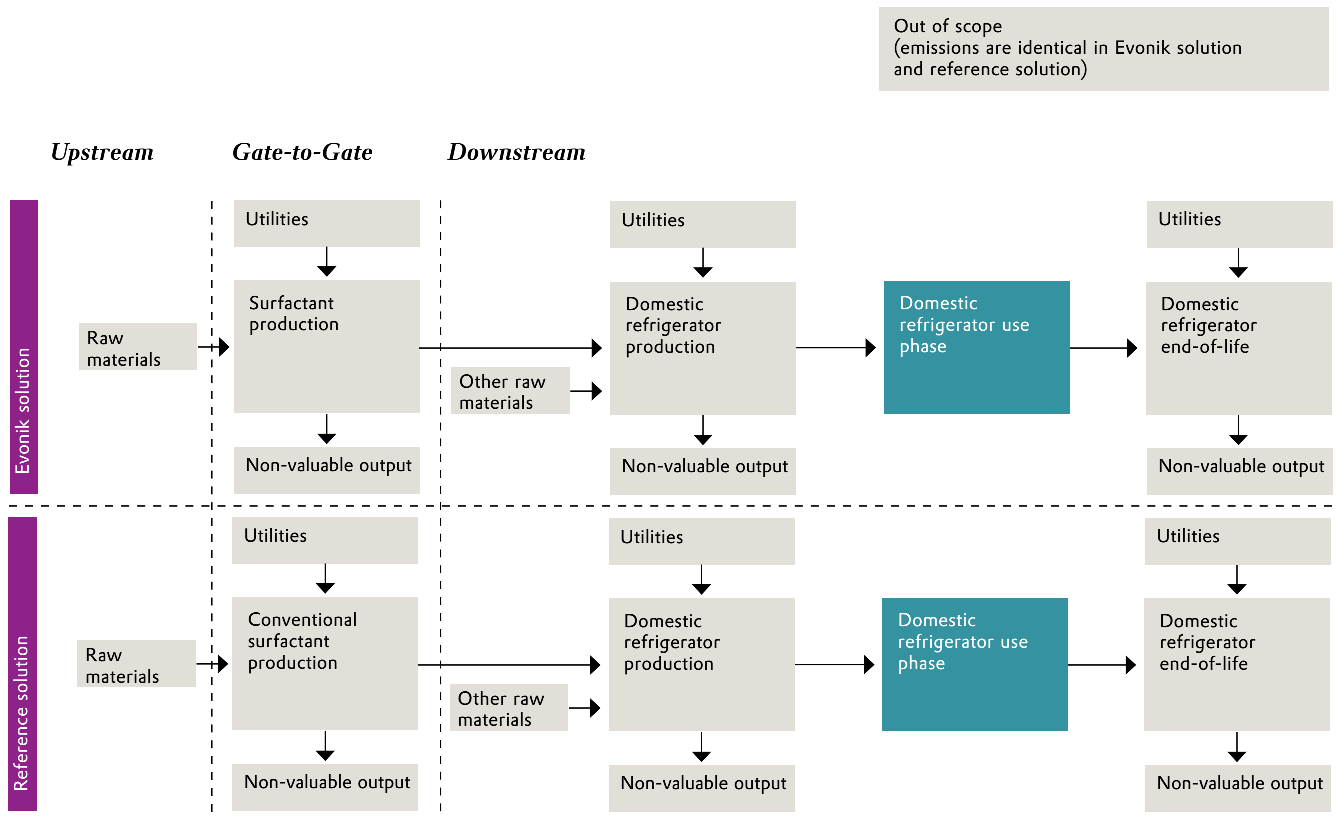
FIGURE 10: Overview of audit parameters for calculating reductions in greenhouse gas emissions from amino acids in animal feed



Reductions in greenhouse gas emissions from optimized insulating materials

Objective of the study	Calculation of greenhouse gas emissions avoided by the use of foam stabilizers in the insulation of refrigerators.
Type of comparison	Category 3 (chemical product vs. chemical product/technology)
Reference solution	Conventional, non-optimized foam stabilizers. The reference solution fulfills the same function, is at the same level of the value chain, is used in the same applications, and is interchangeable for a typical customer as a commercially available solution.
Functional unit	One metric ton of foam stabilizers in PU foam with a life expectancy of 12 years (use phase only).
Temporal and geographical reference	The savings in the use phase were calculated for the "refrigerator" use case for the USA, Europe, and China. For this purpose, the following parameters were determined for each region, to ensure that calculation of the greenhouse gas emissions saved is as regionally specific as possible: refrigerator volume, proportion of additives in the polyurethane foam, and energy consumption of the refrigerator. Using an average energy mix calculated for each region from GaBi data provided by the Sphera Solutions GmbH, it was ultimately possible to calculate greenhouse gas emission savings for the sales volumes of foam stabilizers in the corresponding regions for 2020.
Calculation method	To determine the reductions in greenhouse gas emissions, the internal Evonik Life Cycle Management team worked in close cooperation with the Comfort & Insulation Business Line of the Specialty Additives division and analyzed the use case via a Carbon Footprint Estimation (CFE): For the use of foam stabilizers the insulation of refrigerators, foam stabilizers optimized by Evonik were compared with the effect of insulation materials manufactured with conventional foam stabilizers. Energy savings were determined on the basis of suitable assumptions and converted into the thus enabled greenhouse gas emission savings. For reasons of simplicity, identical emissions (for example, those associated with the manufacture and disposal of foam stabilizers) were not taken into account. This approach had no impact on the amount of savings.
Significance of the contribution of the Evonik product to the total reductions for the application	The calculated reductions refer to the entire value chain of the selected application. However, the optimized Evonik foam stabilizers are the key components responsible for achieving reductions in greenhouse gas emission. The optimized foam stabilizers therefore make a fundamental contribution to the amount of avoided greenhouse gas emissions.
Supplementary notes	No scenario analyses for future developments were performed. Allocation of the avoided emissions to the companies involved in the value chain was not performed due to the fundamental contribution of the Evonik products.

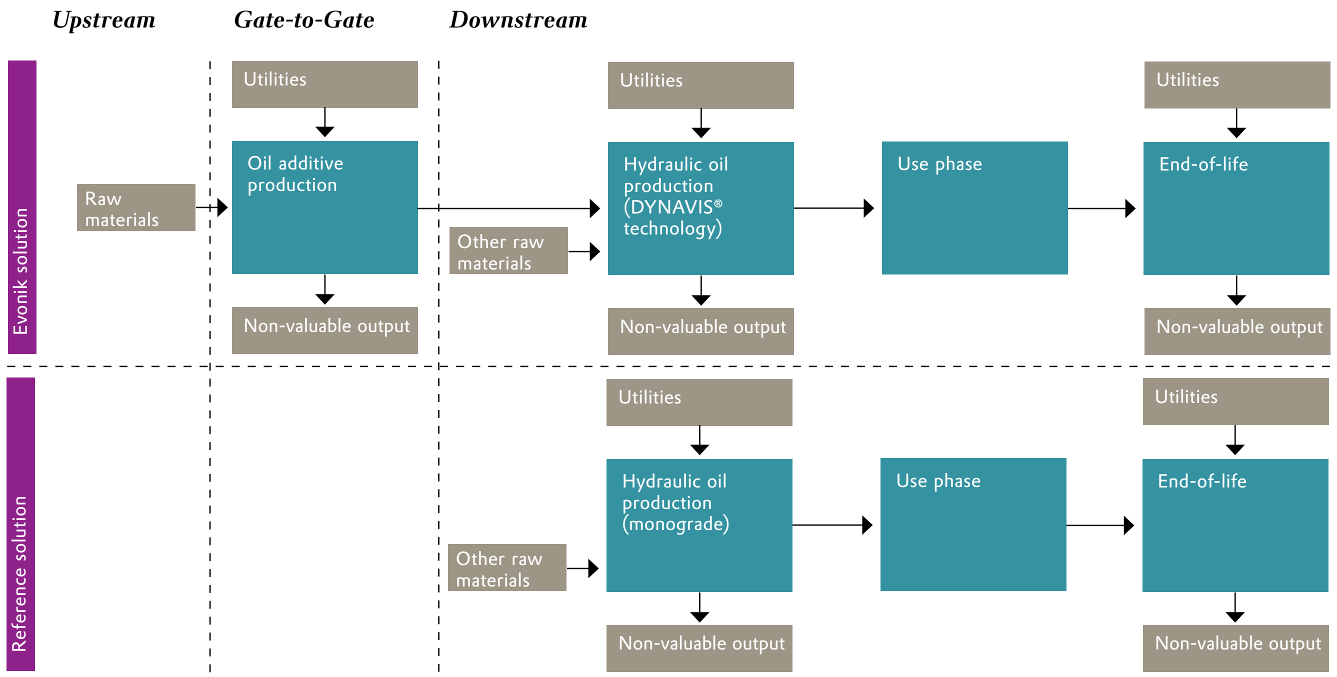
FIGURE 11: Overview of audit parameters for calculating reductions in greenhouse gas emissions from improved insulation materials (refrigerator insulation)



Reductions in greenhouse gas emissions from improved hydraulic oils

Objective of the study	Calculation of greenhouse gas emissions avoided by using DYNAVIS® technology in hydraulic oils of hydraulic construction machinery as compared with conventional hydraulic oils.
Type of comparison	Category 3 (chemical product vs. chemical product / technology)
Reference solution	Conventional hydraulic oils without DYNAVIS® technology (monograde). The reference solution fulfills the same function, is at the same level of the value chain, is used in the same applications, and is interchangeable for a typical customer as a commercially available solution.
Functional unit	Operation of a hydraulic construction machine moving 1 million metric tons of mass.
Temporal and geographical reference	The model is mainly based on data from Europe. The reference year is 2018. Savings refer to the global use of the DYNAVIS® technology. The global amount sold of the corresponding Evonik oil additives to the hydraulic oil industry in 2020 was used to calculate the total savings.
Calculation method	The internal Evonik Life Cycle Management team, working in close cooperation with the Oil Additives Business Line, has performed Life Cycle Assessments (LCA) in 2020, partly based on an earlier, externally certified LCA, to determine savings in greenhouse gas emissions. In this LCA, three different hydraulic oils, based on Evonik DYNAVIS® technology, were compared across their entire life cycle (cradle to grave) with a conventional monograde hydraulic oil. To take the use phase into account, all hydraulic oils were used in field tests in a mid-sized excavator. While the oil drain interval of the monograde fluid is 2,000 hours, the other three fluids need to be changed after 4,500 hours. For reasons of simplicity, identical emissions (for example, those associated with the manufacture and disposal of the rest of the vehicle other than the hydraulic oil) were not taken into account. This approach had no impact on the amount of the savings determined. The DYNAVIS® technology was used less often globally than conventional hydraulic oil in 2020. Reductions in greenhouse gas emissions were calculated on the basis of emissions in the life cycles of the hydraulic oils and the fuel savings determined for the hydraulic oil based on DYNAVIS® technology (use phase).
Significance of the contribution of the Evonik product to the total reductions for the application	The calculated reductions refer to the entire value chain of the selected application. However, Evonik's DYNAVIS® technology is the key component responsible for achieving reductions in greenhouse gas emissions. DYNAVIS® technology therefore makes a fundamental contribution to the amount of avoided greenhouse gas emissions.
Supplementary notes	No scenario analyses for future developments were performed. Allocation of avoided emissions to the companies involved in the value chain was not performed due to the fundamental contribution of the Evonik product.

FIGURE 12: Overview of audit parameters for calculating reductions in greenhouse gas emissions due to improved hydraulic oils (Identical emissions for the Evonik and the reference solution that are e.g. caused during the production of excavators are not considered.)



Independent Practitioner's Report on a Limited Assurance Engagement on Greenhouse Gas Emissions Data[1]
To Evonik Industries AG, Essen

We have performed a limited assurance engagement on the disclosures denoted with "√" (hereinafter "Greenhouse Gas Emissions Data") in the brochure "Evonik Carbon Footprint 2020" of Evonik Industries AG, Essen (hereinafter: "the Company"), for the period from 1 January to 31 December 2020 (hereinafter "the Brochure"). Our engagement in this context relates solely to the disclosures denoted with the symbol "√".

RESPONSIBILITIES OF THE EXECUTIVE DIRECTORS

The executive directors of the Company are responsible for the preparation of the Brochure in accordance with the criteria of relevance, completeness, consistency, transparency, and accuracy (hereinafter "GHG Protocol Criteria") set out on pages 8 and 9 of the publication "A Corporate Accounting and Reporting Standard – Revised Edition" of the Greenhouse Gas Protocol Initiative (World Business Council of Sustainable Development/World Resources Institute) and for the selection of the disclosures to be evaluated.

This responsibility of Company's executive directors includes the selection and application of suitable methods to prepare the Brochure as well as making assumptions and estimates related to individual sustainability disclosures, which are reasonable in the circumstances. Furthermore, the executive directors are responsible for such internal control as they have considered necessary to enable the preparation of the Brochure that is free from material misstatement whether due to fraud or error.

INDEPENDENCE AND QUALITY CONTROL OF THE AUDIT FIRM

We have complied with the German professional provisions regarding independence as well as other ethical requirements.

Our audit firm applies the national legal requirements and professional standards – in particular the Professional Code for German Public Auditors and German Chartered Auditors ("Berufssatzung für Wirtschaftsprüfer und vereidigte Buchprüfer": "BS WP/vBP") as well as the Standard on Quality Control 1 published by the Institut der Wirtschaftsprüfer (Institute of Public Auditors in Germany; IDW): Requirements to quality control for audit firms (IDW Qualitätssicherungsstandard 1: Anforderungen an die Qualitätssicherung in der Wirtschaftsprüferpraxis – IDW QS 1) – and accordingly maintains a comprehensive system of quality control including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

PRACTITIONER'S RESPONSIBILITY

Our responsibility is to express a limited assurance conclusion on the disclosures denoted with "√" in the Brochure based on the assurance engagement we have performed. Within the scope of our engagement, we did not perform an audit on external sources of information or expert opinions, referred to the Brochure.

We conducted our assurance engagement in accordance with the International Standard on Assurance Engagements (ISAE) 3000 (Revised): Assurance Engagements other than Audits or Reviews of Historical Financial Information, issued by the IAASB. This Standard requires that we plan and perform the assurance engagement to allow us to conclude with limited assurance that nothing has come to our attention that causes us to believe that the Company's Greenhouse Gas Emissions Data denoted with "√" in the Brochure for the period from 1 January to 31 December 2020 have not been prepared, in all material aspects, in accordance with the relevant GHG Protocol Criteria. This does not mean that a separate conclusion is expressed on each disclosure so denoted.

[1] PricewaterhouseCoopers GmbH has performed a limited assurance engagement on the German version of the disclosures denoted with "√" in the brochure "Evonik Carbon Footprint 2020" and issued an independent assurance report in German language, which is authoritative. The following text is a translation of the independent assurance report.

In a limited assurance engagement, the assurance procedures are less in extent than for a reasonable assurance engagement and therefore a substantially lower level of assurance is obtained. The assurance procedures selected depend on the practitioner's judgment.

Within the scope of our assurance engagement, we performed amongst others the following assurance procedures and further activities:

- Identification of likely the risks of material misstatement in the Greenhouse Gas Emissions Data under consideration of the GHG Protocol Criteria.
- Inspecting documentation of processes and systems and further documents of the Greenhouse Gas Emissions Data 2020.
- Evaluation of the procedures and systems that represent the basis for determination of the baseline/reference values for selected emission-avoiding products and solutions within the Greenhouse Gas Emissions Data 2020.
- Inquiries of the personnel that are responsible for the determination of the Greenhouse Gas Emissions Data 2020.
- Inquiries of the personnel of selected Business Lines involved in performing the calculations for selected emission-avoiding products and solutions.
- Understanding the individual calculation steps for both the absolute total of greenhouse gas emissions as well as emissions avoided through the use of products and solutions of the product portfolio in the fiscal year 2020.
- Checking the consistent application of the baseline and reference values for selected emission-avoiding products and solutions.
- Comparing selected transaction data used in the calculations with information from company-internal systems.
- Comparing selected emission factors used in the calculation of the Greenhouse Gas Emissions Data 2020 with external sources.

ASSURANCE CONCLUSION

Based on our limited assurance procedures performed, nothing has come to our attention that causes us to believe that the disclosures denoted with "√" in the Company's Greenhouse Gas Emissions Data for the period from 1 January to 31 December 2020 have not been prepared, in all material aspects, in accordance with the GHG Protocol Criteria.

EMPHASIS OF MATTER – USE OF ESTIMATES AND ASSUMPTIONS

Without qualifying our conclusion, we refer to the fact that the quantification of Greenhouse Gas Emissions Data, due to insufficient scientific knowledge to determine emission factors and information to combine emission data of several gases is subject to inherent limitations and is by nature partly based on estimates and assumptions.

INTENDED USE OF THE ASSURANCE REPORT

We issue this report on the basis of the engagement agreed with the Company. The assurance engagement has been performed for purposes of the Company and the report is solely intended to inform the Company as to the results of the assurance engagement. The report is not intended to provide third parties with support in making (financial) decisions. Our responsibility lies solely toward the Company. We do not assume any responsibility towards third parties.

Essen, 22 February 2021
PricewaterhouseCoopers GmbH | Wirtschaftsprüfungsgesellschaft

Hendrik Fink
Wirtschaftsprüfer
(German Public Auditor)

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