We create chemistry

BASF Method for Product Carbon Footprints

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Document Change Control / History

Change History

Date	Authors	Version	Remarks
20.5.2021	Dr. Nicola Paczkowski, Dr. Jan Schoeneboom Corporate Sustainability, BASF SE Ludwigshafen	1.0	First version, distributed via website to suppliers and consultants

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ABOUT THIS DOCUMENT

This document is meant as a technical guidance to help suppliers and LCA analysts, respectively, to calculate product carbon footprints in the context of BASF's Supplier CO_2 Management Program. It is based on BASF's own methodology to calculate cradle-to-gate product carbon footprints. We ask our suppliers to adhere to the guidance and requirements given in this document.

1. Introduction

We invite our suppliers to join our Supplier CO_2 Management Program. In this program, we first aim to achieve transparency on the product-related CO_2 emissions of our purchased raw materials. In a second phase, the improvement phase, we will jointly identify levers and targets with our suppliers to reduce these GHG emissions.

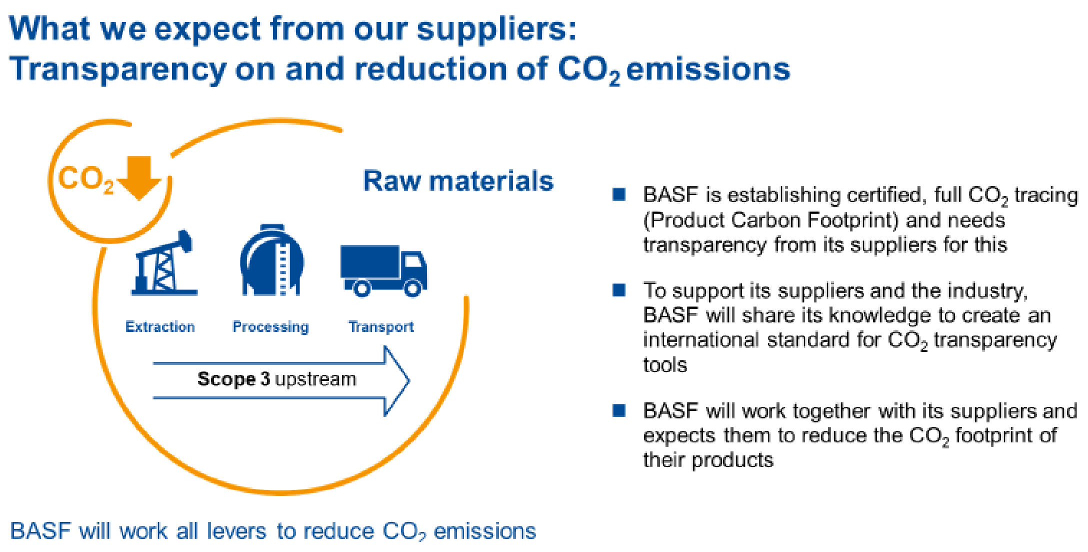

Figure 1 What we expect from our suppliers

BASF's purpose for obtaining supplier-specific PCF data

As a supplier to various industries, Product Carbon Footprints (PCFs) for our portfolio will help provide transparency for the carbon footprint of our customers' purchased materials (Scope 3 emissions of customers) as well as the PCFs of our customers' products made from these materials. This transparency is crucial for our customers who are strongly and increasingly targeting GHG Scope 3 tracking and reduction, but also important to our investors and the authorities.

BASF has introduced a new digital solution to calculate cradle-to-gate PCFs for all products in its portfolio worldwide to respond to the growing needs of our customers. The digital solution is able to provide carbon footprints for about 45,000 sales products by BASF globally by the end of 2021 (Figure 2).

Figure 2 Scope of BASF digital solution for PCFs

The development of the PCF approach profits from BASF's over 25 years of experience with third-party validated methodologies to quantify sustainability performance of our complex portfolio in the economic, ecological, and social dimension. The new digital solution focuses on the ecological dimension of sustainability.

BASF calculates the Partial Product Carbon Footprint based on ISO14067:2018 for carbon footprint of products, which builds on the principles and requirements of the ISO standards 14040:2006 and 14044:2006 for life cycle assessment. Other LCA-related guidance documents such as WBCSD Chemicals[1] or PlasticsEurope[2] are followed when making decision about allocation schemes.

To enable comparable PCFs and a level playing field, BASF supports establishing global standards for calculating PCFs of chemical products and is actively involved in defining standards for PCFs in the chemical industry.

BASF’s digital solution currently encompasses primary data from our own plants and high-quality average data from databases or from third parties for purchased energy and raw materials. To serve our customers with the lowest carbon footprint materials possible, focusing only on improving Scope 1 and 2 emissions is not enough. On average, around 70% of the carbon footprint of our products originates from our purchased raw materials (upstream Scope 3 emissions).

Therefore, we approach our suppliers and ask them to provide their specific product carbon footprints of our purchased raw materials.

[1] WBCSD Chemicals 2013, Life Cycle Metrics for Chemical Products: A guideline by the chemical sector to assess and report on the environmental footprint of products, based on life cycle assessment.
[2] PlasticsEurope recommendation on steam cracker allocation, Life Cycle and Sustainability working group of PlasticsEurope, 2017.

2. Methodological principles and requirements according to ISO 14067:2018

2.1 Definition of declared unit

The declared unit for which the PCF of a product system is calculated is 1 kg of unpackaged product at factory gate, regardless of its state (solid, liquid, gas), as its specific density is considered.

2.2 Product System

The product system of the cradle-to-gate PCF is the sum of GHG emissions, expressed as CO_2 equivalents, from the extraction of the resources up to production of the final product. It shall include all product related direct GHG emissions from Scopes 1, 2 and 3 (Figure 3).

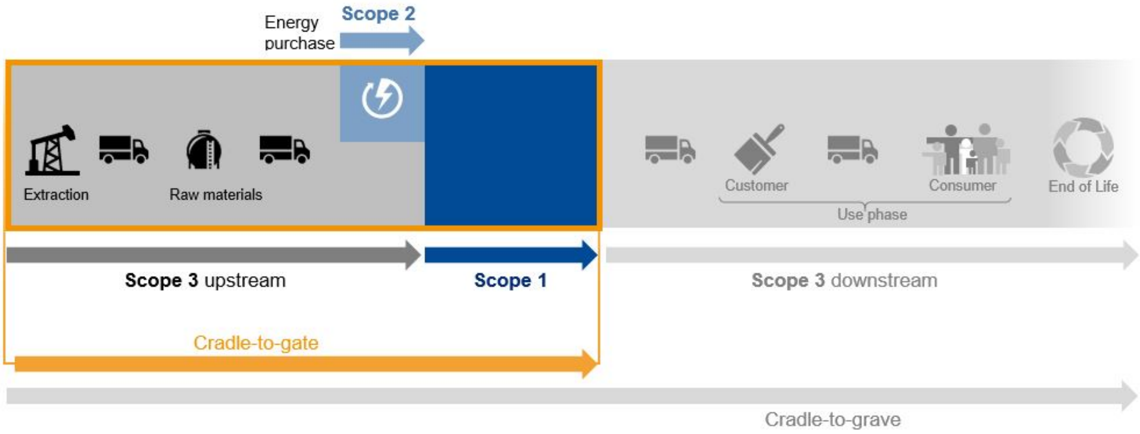

Figure 3 System boundary definition according to GHG Protocol

Scope 1 direct CO_2e emissions result from production processes that are owned or controlled by the reporting company. They arise from e.g.,

- emissions from chemical reactions,
- emissions stemming from waste treatment w/o energy use (e.g. flares),
- emissions from fuel and residues incineration in process plants.

Scope 2 CO_2e emissions result from the generation of purchased energy such as electricity and steam.

Scope 3 upstream CO_2e emissions result e.g., from the use of purchased raw materials and indirect emissions due to the generation and extraction of fuels consumed by the product-processing plants.

2.3 System boundary

The system boundary is described in Table 2-1.

Table 2-1 System boundary of cradle-to-gate product system*

Included	Excluded
✓ Raw materials (incl. catalysts that are consumed in the reaction)	× Packaging
✓ Energy consumption	× Outbound transports
✓ Utilities	× Capital goods / infrastructure / including catalysts that are re-generated / recovered
✓ Manufacturing	× Non-production-related products[3]
✓ Inbound transportation	× Employee commuting / business travel
✓ Site-to-site transportation	
✓ Treatment of process waste	
✓ Wastewater treatment	

**for definition of terms see glossary*

2.4 Data requirements

2.4.1 The data needs matrix

The requirements for use of primary (company-specific) or secondary data (Scope 2 and Scope 3) for GHG emissions depend on the level of influence the company has on the process[4].

The following three cases are distinguished in the data needs matrix (Table 2-2):

1. Situation 1: the process is run by the company
2. Situation 2: the process is not run by the company, but the company has access to (company-)specific information
3. Situation 3: the process is not run by the company and the company does not have access to (company-)specific information

[3] Non-production-related procurement (often called indirect procurement) consists of purchased goods and services that are not integral to the company's products but are instead used to enable operations. Non-production-related procurement may include capital goods, such as furniture, office equipment, and computers. Source: GHG Protocol Corporate Value Chain Standard.

[4] A set of interrelated or interacting activities that transforms or transports a product. Source: GHG Protocol Corporate Value Chain Standard.

Table 2-2 Data needs matrix

		Data requirements
Situation 1: process run by the company	**Scope 1**	Collect primary (company-specific) data for both, activity data and direct emissions, via a bottom-up approach (by unit-process) and for each site. This includes own production plants, power plants, transport activities, waste and wastewater treatment. For transportation activities use high quality CO_2e emission factors, in this case fleet specific.
Situation 2: process not run by the company but with access to company-specific information	**Scope 2**	Data sources for Scope 2 emissions should be supplier-specific (also referred to as market-based emission factors[5]) from energy suppliers for the reference period (Note: The Scope 3 upstream emissions for the fuels that go into the energy production have to be added as well, in order to arrive at the full PCF of the purchased energy. For renewable energy sources, the Scope 3 upstream emissions may be neglected).
	Scope 3	Use a supplier-specific PCF for raw materials or fuels. The quality of the supplier-specific PCF has to be evaluated and checked for appropriateness according to the GHG Protocol Product Standard or ISO 14067:2018.
Situation 3: process not run by the company and without access to company-specific information	**Scope 2**	Use location-based factors for external energy supply.
	Scope 3	The below hierarchy for raw materials, utilities and fuels shall be applied: 1. Most recent and valid association data (e.g., Plastics Europe) 2. Sphera / GaBi 3. Ecoinvent 4. Own LCA models (as proxies/estimations) For transportation activities use high quality CO_2e emission factors from EcoTransIT or Sphera/GaBi.

2.4.2 Data quality requirements of primary data collection

Minimum criteria on data quality of primary data collection and all processes related to Scope 1 operations are shown in Table 2-3.

[5] The purchase and use of green electricity can be considered in the market-based emission factor provided that the criteria in ISO 14067:2018, Chapter 6.4.9.4.4 are met.

Table 2-3 Data quality requirements on primary data (Scope 1)

Data Quality Criteria	Requirement
Geographical representativeness	Data from all sites relevant for the product under study.
Technological representativeness	Specific (actual) technology from the production plants for product under study.
Temporal representativeness	The data considered • refers to the most recent annual administration period, • is not older than 3 years, • covers at least 12 calendar months to avoid seasonal changes.
Consistency	A minimum of consistency and justification will have to be ensured by checking for 15% deviation from the previous year's primary data. In case of a bigger deviation, a justifying comment must be provided by the practitioners.
Completeness	See chapter 2.4
Reliability	Data based on measurements of actual and site-specific internal production data.
Precision	Measured/calculated and internally verified, plausibility checked by (internal) reviewer.

2.4.3 Selection of secondary data and use of proxy data

The below hierarchy for the selection of secondary data for Scope 3 processes shall be applied:

1. If the production origin (region or country) of the supplied raw material and fuel is known choose a regional or country-specific production mix.
2. If the production origin is not known choose a regional or country-specific consumption mix based on the location of your tier-1 supplier.
3. If there is no regional or country-specific dataset available choose the same raw material or fuel from another country or region which is the most appropriate in terms of GHG emissions.
4. If the specific raw material or fuel is not available choose an appropriate proxy e.g., a chemical substance from the same chemical group.

2.4.4 Reporting on secondary or background data

Secondary or background data concern processes outside the operational control of the company. The source of secondary data must be specified in the report. The share to which extent secondary data content is used shall be specified in relation to all Scope 2 and Scope 3 GHG emissions by CO_2 equivalents.

As part of the quality check, the most relevant contributions of LCIs regarding their plausibility should be assessed and reported in the study report, including at minimum year of publication, database source and version.

2.4.5 Modelling of waste and wastewater

For modelling the GHG impact from waste and wastewater treatment, appropriate generic LCI datasets from LCA databases may be used.

As approximation, specific emission factors can be used. They should be calculated by considering the following:

GHG emissions from waste treatment

- Waste for material recovery: see chapter 2.6.2 (if the recommended cut-off approach is applied, no GHG emissions are to be allocated)
- Waste for energy recovery:
  - 100% conversion to CO_2e based on carbon content
  - CO_2e credit for heat production may be considered
  - CO_2e from fuel needed for combustion process
- Waste to underground landfill: no GHG emissions to be allocated
- Waste to surface landfill: 100% conversion to CO_2e based on carbon content
- Waste to incineration:
  - 100% conversion to CO_2e based on carbon content
  - CO_2e from fuel needed for combustion process

GHG emissions from wastewater treatment

- If the Total Organic Carbon (TOC) load of your processes is known:
  - 100% conversion to CO_2e based on carbon content
  - Utilities for treatment of wastewater and sludge incineration included

2.5 Cut-off criteria

The LCI data collection shall aim for completeness – a closed mass and energy balance – and avoid cut-offs altogether. Where quantitative data are available, they shall be included. However, no undue effort should be spent on developing data of negligible significance concerning GHG emissions.

Cut-offs may become necessary in cases where no data are available, where elementary flows are very small (below quantification limit), or where the level of effort required to close data gaps and to achieve an acceptable result becomes prohibitive.

1. In cases where no matching life cycle inventories are available to represent a raw material or where processes and elementary flows are very small (below quantification limit), proxy data should be applied based on conservative assumptions regarding GHG emissions.
2. Include all material inputs that have a cumulative total of at least 98% of the total mass inputs to the unit process.
3. Include all energy inputs that have a cumulative total of at least 98% of total energy inputs to the unit process.

2.6 Allocation

The application of allocation rules significantly determines the results. Special attention should therefore be paid to the multi-output allocation.

2.6.1 Multi-output Allocation

When multi-output allocation becomes necessary during the data collection phase, a consistent allocation approach for all possible (material and energetically) types of co-products used following a decision hierarchy shall be applied:

1. Allocation methods in line with published and accepted product category rules (PCR) of analogous processes shall be applied where available, e.g., PlasticsEurope. See Table 2-4.
2. Co-products which are only used in energy recovery shall be treated by system expansion by substitution.
3. If all co-products are gases and include hydrogen, volume allocation shall be applied.
4. Following the guidance of the WBCSD Chemicals[6], the ratio of the economic value of co-products is a criterion to decide between physical allocation and economic allocation: if the ratio is equal or less than five (5), then mass allocation shall be applied, else economic allocation shall be applied. Economic allocation factors are calculated from average prices over multiple years to average out fluctuations.

Table 2-4 Examples of product systems using a PCR to allocate co-products

Product system	Allocation approach	Standard/Rationale followed
Steam crackers	Specific mass allocation. Products are categorized in intended and co-products. Energy demands and emissions are allocated by mass to intended products. Feedstocks are allocated by mass to all intended and by-products.	PlasticsEurope steam cracker allocation paper[7]
C12-14 Fatty alcohols (oleo), methyl esters, refined oils, and crude oils from oil palm, refined- and crude oils from Coconut	Mass	ERASM[8]

[6] WBCSD Chemicals 2013, Life Cycle Metrics for Chemical Products: A guideline by the chemical sector to assess and report on the environmental footprint of products, based on life cycle assessment.
[7] PlasticsEurope recommendation on steam cracker allocation, Life Cycle and Sustainability working group of PlasticsEurope, 2017
[8] ERASM SLE (2014). Surfactant Life Cycle and Ecofootprinting Project; updating the life cycle inventories for commercial surfactant production. Final Report for ERASM (www.erasm.org), 186 p.

Toluene diisocyanate (TDI), Methylene diphenyl diisocyanate (MDI)	Stoichiometric	ISOPA[9]
Chlorine (chlor-alkali process)	Dry matter	Euro Chlor[10]
Caprolactam	System expansion by substitution for caprolactam and ammonium sulfate	PlasticsEurope[11]

2.6.2 End-of-Life Allocation

End-of-Life allocation generally follows the requirements of ISO 14044, section 4.3.4.3. Such allocation approaches address the question of how to assign impacts from virgin production processes to material that is recycled and used in future product systems.

Two main approaches are commonly used in LCA studies to account for end-of-life recycling and recycled content.

- Cut-off approach (also known as 100:0 or recycled content approach) – burdens or credits associated with material from previous or subsequent life cycles are not considered i.e., are "cut-off". Therefore, scrap input to the production process is considered to be free of burdens but, equally, no credit is received for scrap available for recycling at end-of-life. This approach rewards the use of recycled content but does not reward end of life recycling.
- Substitution approach (also known as 0:100, closed-loop approximation, recyclability substitution or end of life approach) – this approach is based on the perspective that material that is recycled into secondary material at end of life will substitute for an equivalent amount of virgin material. Hence a credit is given to account for this material substitution. However, this also means that burdens equivalent to this credit should be assigned to scrap used as an input to the production process, with the overall result that the impact of recycled granulate is the same as the impact of virgin material. This approach rewards end of life recycling but does not reward the use of recycled content.

Other approaches cover, e.g. the Circular Footprint Formular[12] or the Umbrella Formula + or Integrated Formula[13].

[9] Toluene Diisocyanate (TDI) & Methylenediphenyl Diisocyanate (MDI) ISOPA, Eco-profiles and Environmental Product Declarations of the European Plastics Manufacturers, 2021
[10] An Eco-profile and Environmental Product Declaration of the European Chlor-Alkali Industry, Chlorine (The chlor--alkali process), Euro Chlor, 2013
[11] An Eco-profile and Environmental Product Declaration of the European Plastic Manufacturers, Polyamide 6 (PA6), PlasticsEurope, 2014
[12] Zampori, L. and Pant, R., *Suggestions for updating the Product Environmental Footprint (PEF) method*, EUR 29682 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76- 00654-1, doi:10.2760/424613, JRC11
[13] https://maki-consulting.com/wp-content/uploads/2016/09/Umbrella-formula_incl._reformulated_Integrated_formula_improved_Wolf_Sep2016-3.pdf

When end-of-life allocation becomes necessary during the data collection phase, an allocation approach in line with published and accepted category rules of analogous processes shall be applied where available. If this is not the case, we recommend using the cut-off approach.

2.7 LCIA methodology

The characterization method focuses on greenhouse gas emissions. The impact of greenhouse gas emissions – such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) is assessed over a fixed period of 100 years according to the Bern model[14]. The PCF, expressed in kg CO_2 equivalents, reflects the climate change impact of air emissions of greenhouse gases (GHGs). Increased GHGs in the troposphere result in warming of the earth's surface.

The climate change category considers that different gases have different climate change impacts on global warming. The total impact is described in CO_2 equivalents. The PCF is calculated considering all six Kyoto gases (Carbon dioxide "CO_2", Methane "CH_4", Nitrous oxide "N_2O", Hydrofluorocarbons "HFCs", Perfluorocarbons "PFCs", Sulphur hexafluoride "SF_6"), plus NF_3, measured by mass and converted into CO_2 equivalents using the 100-year global warming potential (GWP) coefficients of the 2013 IPCC 5th Assessment Report without climate carbon feedbacks. This includes CO_2 from land use and land use change.

For example, the correct characterization methods in Sphera's Product Sustainability Solution (GaBi) are called

- *IPCC AR5 GWP100, excl biogenic carbon, incl Land Use Change, no norm/weight*
- and *IPCC AR5 GWP100, incl. biogenic carbon, incl Land Use Change, no norm/weight*.

In other LCA Software tools the names can differ from that but shall contain the same characterization factors.

[14] Forster, P., V. Ramaswamy, P. Artaxo, T. Berntsen, R. Betts, D.W. Fahey, J. Haywood, J. Lean, D.C. Lowe, G. Myhre, J. Nganga, R. Prinn, G. Raga, M. Schulz and R. Van Dorland, 2007: Changes in Atmospheric Constituents and in Radiative Forcing. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

2.7.1 Biogenic carbon in product and biogenic removals

The biogenic emissions and removals shall be considered in the PCF quantification and the biogenic carbon content of the product shall be reported. Biogenic carbon balance should be closed.

2.8 Sensitivity analysis and quality checks of results

Sensitivity analyses with different modelling choices (e.g. another dataset for a raw material, another allocation method for the foreground product system) should be performed in order to test the robustness of the result.

Validation of the resulting PCF of a product should be obtained by experts, such as technology experts, controllers, plant managers, site managers, and LCA experts.

2.8.1 Quick checklist

The following short checklist shall help the LCA practitioner to validate the PCF.

- Check the overall mass balance (includes raw material inputs, product outputs, wastes as well as emissions into air and water)
- Check the elementary balance by doing a stochiometric calculation
- Check if on-stage direct emissions are realistic, e.g. by carbon balance
- Check utility consumption (plausible?)
- Check allocation factors (in line with chapter 2.6.1?)
- Check the appropriateness of the secondary datasets selected for Scope 3:
    - Check if technology represented in the LCI is the appropriate.
    - Check if the application of proxies is appropriate.
    - If supplier data is available replace dataset.
- CO_2e benchmark against own calculations, same product from other sites/plants companies, existing LCA data, LCIs from other third-party databases.
- Check why there are significant deviations to LCA benchmark data

3. Reporting requirements

As a minimum requirement the results of the PCF calculation (including and excluding biogenic emissions and removals) along with the following information should be reported. Any additional information available such as a PCF report or a critical review statement should be added or attached to complement and provide more details to the information enquired by the BASF questionnaire (please see below the mandatory part).

Table 3-1 BASF's PCF questionnaire

#	Question	Explanatory information
1	**Name of supplier**	This field is automatically filled in
2	**Product name**	This field is automatically filled in. *For this document the product name was defined as "PRODUCT".*
3	**Production location (city1, country1; city2, country2; etc.)**	Please enter the city and country name(s) of the location(s), where you produce "PRODUCT" that is supplied to BASF.
4	**Name of producer, if different from supplier**	If you are not the producer, please enter the name of the producer of "*PRODUCT*" that you supply to BASF.
5	**Which BASF site do you supply your product to (city1, country1; city2, country2; etc.)**	Please state the locations(s) of the BASF site(s) that you supply with "PRODUCT".
6	**Cradle-to-gate PCF excluding biogenic CO_2 emissions and removals [in kg CO_2e/kg product]**	Please enter the calculated PCF as figure in kg CO_2 equivalents per kg of "PRODUCT". Please exclude any biogenic CO_2 emissions and removals in your calculation but have CO_2 emissions from land use and land use change included.
7	**Cradle-to-gate PCF including biogenic CO_2 emissions and removals [in kg CO_2e/kg product**]	Please enter the calculated PCF as figure in kg CO_2 equivalents per kg of "PRODUCT". This time please include additionally the biogenic CO_2 emissions and removals when "PRODUCT" is (partly) based on biomass.
8	**If your product is (partially) based on biomass, please state the amount of biogenic carbon contained [in kg biogenic carbon/kg product]**	When "PRODUCT" is (partly) based on biomass, please fill in the amount of biogenic carbon content of "PRODUCT" in kg of biogenic carbon per kg of "PRODUCT". This information can be calculated from the molecular formula of "PRODUCT" and the percentage of biomass contained.
9	**Please confirm: Is your PCF calculation a cradle-to-gate calculation including the GHG emissions from purchased raw materials (Scope 3) and energy (Scope 2), as well as from own plants (Scope 1)?**	This question asks you to confirm that the PCF data that you provide to BASF is a cradle-to-gate (partial) product carbon footprint including your own and all upstream emissions as defined by the system boundaries described in chapter 2. Please select yes or no from the dropdown list.
10	**Did you follow a product category rule (PCR) in your calculations?**	If yes, please select yes or no from the dropdown list.
10a	*If yes, please specify PCR*	If yes, please state name and the system operator of the PCR that have been following in your calculation.
11	**Was the PCF calculation conducted by an internal or external LCA analyst?**	Please select internal or external from the dropdown list.

11a	*If external PCF/LCA analyst, please state the name of the organization*	If yes, please state the name of the consultancy company that conducted the PCF calculation for "PRODUCT".
12	**Was your PCF calculation externally reviewed, verified, or certified?**	This question asks if your PCF calculation of "PRODUCT" has been externally reviewed, verified, or certified by an external third party. Please select yes or no from the dropdown list.
12a	*If yes, please state reviewer, verification, or certification company*	If yes, please state the name of the company or organization that reviewed, verified, or certified the PCF calculation of "PRODUCT".
13	**Geographical reference: What site/country/region (or global) does the data of your study refer to?**	This question about the geographical reference asks for the location or geographical area from which your process data and emissions factors were obtained to calculate the PCF of "PRODUCT". Please state the country(ies) or region(s) or global that your data refers to.
14	**Time-related reference: What year does the data of your study refer to?**	This question about the time-related reference asks for the year for which your process data and emission factors were obtained to calculate the PCF of "PRODUCT". Please state the year that your activity data refers to.
15	**Technological reference: What production technology does the data reflect?**	This question about the technological reference asks for the specific technology or the technology mix used from which data were obtained to calculate the PCF of "PRODUCT".
16	**What time period does your data cover (e.g. one year, three years average, batch production)?**	This question asks for the time period for which activity data were collected to calculate the PCF of "PRODUCT".
17	**Please indicate the precision of the data used for modelling your production**	Please select a) (externally) verified data based on measurement or b) (internally validated) primary data measured/calculated or c) primary data partly based on assumptions or d) qualified estimate or e) non-qualified estimate from the dropdown list.
18	**Did you use supplier specific LCI data in your model for the raw materials and utilities purchased?**	Please select a) yes, for 100% of purchased materials/utilities or b) partly, for >50% of purchased materials/utilities or c) partly, for <50% of purchased materials/utilities or no from the dropdown list.
18a	*If secondary data used, please state source of data*	If you selected either a), b) or c) please specify from which source you derived your secondary data.
19	**Is your process a multi-output process and did you have to allocate the inputs and outputs of your production data or use system expansion?**	Please select yes or no from the dropdown list.
19a	*If yes, please specify the allocation approach used*	If yes, please describe the allocation method that you used to partition the inputs and output flows of your (unit) process among "PRODUCT" and one or more co-products. Please see chapter 2.6.1 for further information on principle allocation approaches and the recommended.

19b	*If yes, please also indicate if your allocation approach is in line with our outlined allocation methodology*	If you selected ‘yes’ in the dropdown list of question 19, please declare if you have followed the BASF decision tree logic for allocation of multi-output processes as described in chapter 2.6.1. Please select yes or no from the dropdown list.
20	**Does your product contain recycled material?**	Please select yes or no from the dropdown list.
20a	*If yes, what allocation approach did you apply in your PCF calculation*	Please select a) cut-off approach or b) substitution approach or c) other from the dropdown list. For information on the different allocation approaches due to recycling please refer to chapter 2.6.2..
20b	*If others, please specify your allocation approach due to recycling*	If you selected ‘other’ in the dropdown list of question 20a, please describe your allocation approach.
21	**Please state the share of recycled material in your product [0-100 %]**	Please fill in the share of recycled material in “PRODUCT” as percentage figure. If “PRODUCT” does not contain any recycled material, please state 0.
22	**Comments and additions**	Please add comments here or share any additional information with us that gives further insights into your calculation or provides explanations for your PCF results.

Annex A Glossary

Acronym	Term	Definition
	Allocation	Partitioning the input or output flows of a process or a product system between the product system under study and one or more other product systems. (ISO 2006)
CO_2e	Carbon Dioxide Equivalent	Carbon dioxide equivalent, or CO_2e is a metric measure representing all greenhouse gases by converting them to the equivalent amount of CO_2.
	Consumption mix	This approach focuses on the domestic production and the imports taking place. These mixes can be dynamic for certain commodities (e.g., electricity) in the specific country/region.
	Cradle-to-gate	An assessment that includes part of the product's life cycle, including material acquisition through the production of the studied product and excluding the use or end-of-life stages. (WRI and WBCSD 2010)
	Cradle-to-grave	A cradle to grave assessment considers impacts at each stage of a product's life cycle, from the time natural resources are extracted from the ground and processed through each subsequent stage of manufacturing, transportation, product use, recycling, and ultimately, disposal. (Athena Institute & National Renewable Energy Laboratory draft 2010)
GWP	Global Warming Potential	GWP is a term used to describe the relative potency, molecule for molecule, of a greenhouse gas, taking account of how long it remains active in the atmosphere. The GWPs currently used are those calculated over 100 years. Carbon dioxide is taken as the gas of reference and given a 100-year GWP of 1.
GHG	Greenhouse Gases	Greenhouse gases constitute a group of gases contributing to global warming and climate change. The Kyoto Protocol, an environmental agreement adopted by many of the parties to the United Nations Framework Convention on Climate Change (UNFCCC) in 1997 to curb global warming, nowadays covers seven greenhouse gases: • the non-fluorinated gases: ○ carbon dioxide (CO_2) ○ methane (CH_4) ○ nitrous oxide (N_2O) • the fluorinated gases: ○ hydrofluorocarbons (HFCs) ○ perfluorocarbons (PFCs) ○ Sulphur hexafluoride (SF_6) ○ nitrogen trifluoride (NF_3) Converting them to carbon dioxide (or CO_2) equivalents makes it possible to compare them and to determine their individual and total contributions to global warming.

ISO	International Organization for Standardization	
LCA	Life Cycle Assessment	The compilation and evaluation of the inputs, outputs, and the potential environmental impacts of a product system throughout its life cycle (ISO 1440:2006).
LCI	Life Cycle Inventory	The phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle (ISO 14040:2006).
LCIA	Life Cycle Impact Assessment	The phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product (ISO 14040:2006).
PCF	Product Carbon Footprint	The Product Carbon Footprint is the most established method for determining the climate impact of a product, considering the total greenhouse gas (GHG) emissions caused to produce a product, expressed as carbon dioxide equivalent. The PCF can be assessed from cradle-to-gate (partial PCF) or from cradle-to-grave (total PCF).
PCR	Product Category Rules	set of specific rules, requirements, and guidelines for developing Type III environmental declarations for one or more product categories. [ISO 14025:2006]
	Production mix	This approach focuses on the domestic production routes and technologies applied in the specific country/region and individually scaled according to the actual production volume of the respective production route. This mix is generally less dynamic.
	Scope 1 Emissions	Scope 1 emissions include GHG that arise from the combustion of fuels owned or controlled by the reporting organization.
	Scope 2 Emissions	Scope 2 emissions include GHG emissions that result from the consumption of purchased or acquired energy such as electricity, heating, cooling, and steam.
	Scope 3 Emissions	Scope 3 emissions include the remainder of indirect GHG emissions which cannot be categorized as energy-related emissions in Scope 2.
	Utilities	The term “utilities” includes here: Electricity, process steam, excess steam, cooling water, demineralized water, process water, compressed air and nitrogen