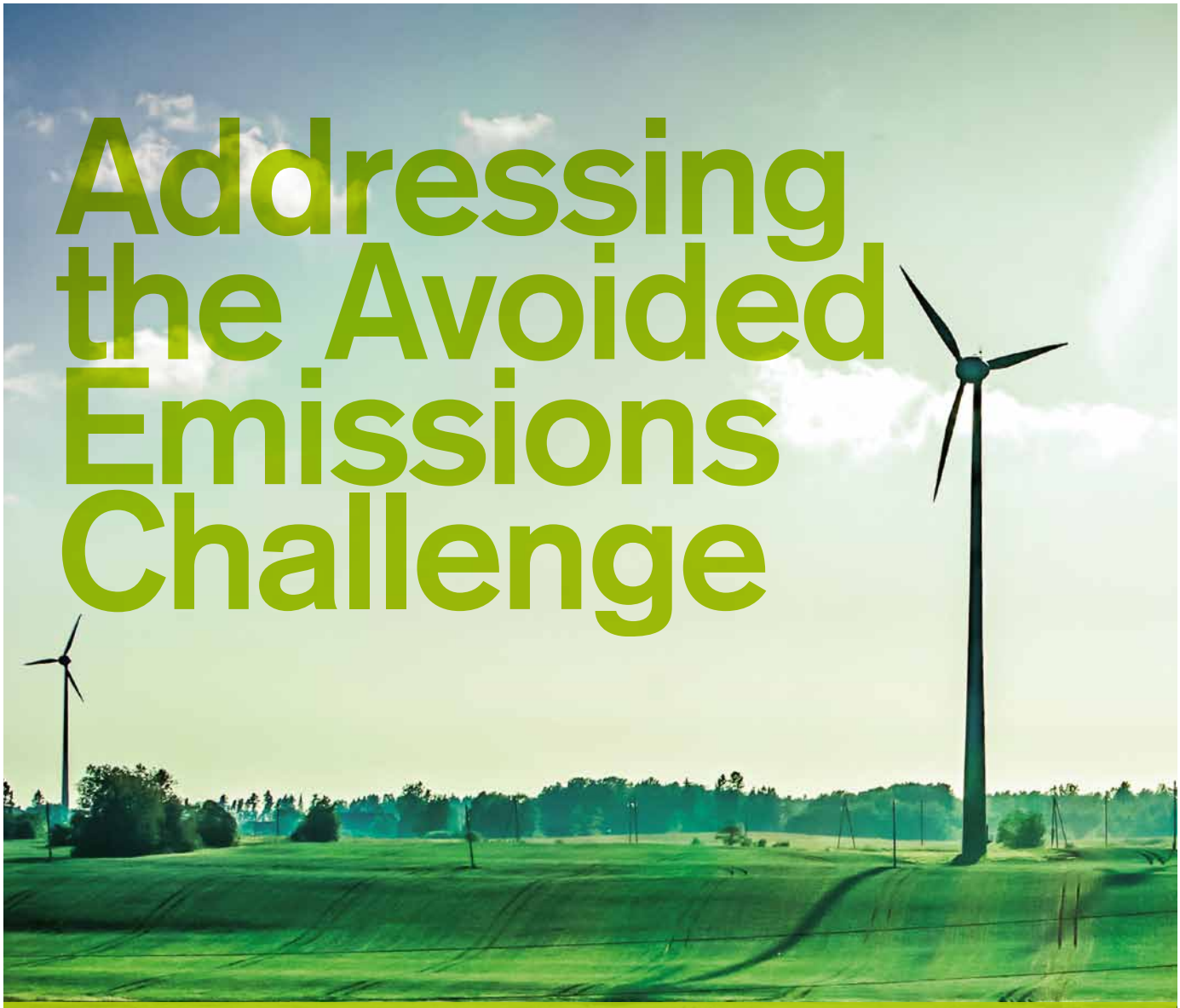

Addressing the Avoided Emissions Challenge

Guidelines from the chemical industry for accounting for and reporting greenhouse gas (GHG) emissions avoided along the value chain based on comparative studies

October 2013

INTERNATIONAL COUNCIL OF CHEMICAL ASSOCIATIONS

wbcsd chemicals

Foreword

"The earth we live on is a precious resource for all"

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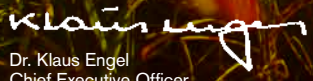

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Developments in science and technology have enabled people to live longer, healthier, more agreeable and more prosperous lives. Minimizing environmental impacts whilst furthering these developments is critical to a sustainable future. The chemical industry contributes to almost every modern technology and has long been developing innovative products that improve sustainability. With that in mind, the industry supports the use of life cycle assessment (LCA) methodologies because these enable the assessment of the environmental impact of products and technologies over their complete life cycle, including production, use and end-of-life handling. As such, they are critical to assessing – and ultimately improving – sustainability.

Greenhouse gas (GHG) emissions are one of the many environmental impacts that LCAs can quantify. By comparing greenhouse gas emissions along the life cycle of two alternative products of equal benefit to users, we can understand which technology avoids greenhouse gas emissions, improving sustainability. LCA standards help to improve the quality and reliability of these assessments. The consistent measurement and reporting of LCAs increases credibility and comparability of the results, leading to better decision making by stakeholders along the value chain. Measuring avoided emissions of greenhouse gases over the value chain of products in particular, is an area where consistency of approach is essential. But, it has often given rise to debate among stakeholders.

To address these concerns, in early 2012 the International Council of Chemical Associations (ICCA) and the World Business Council of Sustainable Development (WBCSD) Chemical Sector project, Reaching Full Potential, formed a taskforce to develop practical guidelines to improve consistency in the assessment and reporting of avoided emissions.

We expect these guidelines to improve reporting consistency across the industry. In the future, we intend to expand them to cover other environmental impacts. We therefore aim to engage all stakeholders in the value chain so as to further improve the guidelines and the quality of our methodology. We believe this is an important step in improving the sustainability of our society.

Acknowledgements

ICCA and WBCSD would like to thank the numerous people that have been involved in the development of this guideline:

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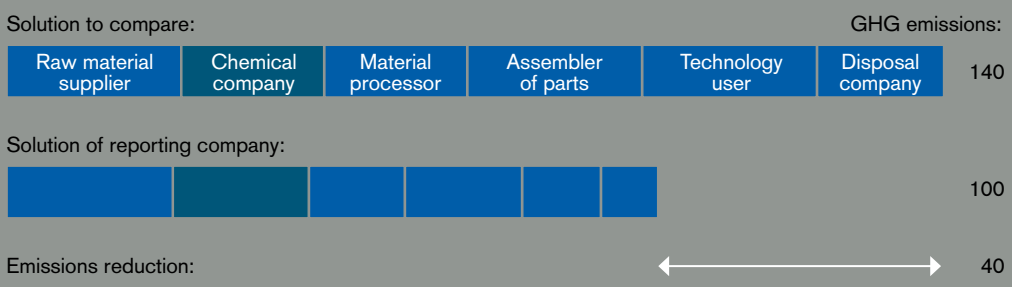
Executive summary

As part of low-carbon technology value chains various chemical industry products aid the reduction of greenhouse gas (GHG) emissions compared to conventional products or compared to the market average (see Figure A)**. Under the terminology of the Greenhouse Gas Protocol international accounting tool, emission reductions of this kind are termed "avoided emissions".**

Figure A. A reduction in GHG emissions is represented by the difference between the life cycle emissions from the solution of the reporting company and the solution to compare to



This document provides guidelines for calculating avoided GHG emissions enabled by chemical products, by comparing two solutions with the same user benefit. It also gives guidance on how to communicate the results. A number of case examples are published on ICCA website (http://www.icca-chem.org/Home/ICCA-publications/Publications-Search-Results/?topic=Climate+Change+and+Energy). These case examples will provide additional insight for users to understand the guidance and reporting requirements. The intention of these guidelines is to support chemical companies in assessing the greenhouse gas emissions avoidance potential of their products. This will support research and development and help the chemical sector communicate credibly to stakeholders the role of chemical products in reducing GHG emissions. The chemical industry hopes that other industries facing similar challenges as the chemical industry may also benefit from these guidelines.

The chemical industry supports the multicriterial approach of Life Cycle Assessment (LCA), as it ensures that studies cover all aspects of the environmental impact. The guidelines therefore build on the internationally accepted requirements of the ISO standards on Life Cycle Assessment (LCA). They also aim to be consistent with leading standards and specifications on carbon footprinting of products, including the GHG Protocol Product Life Cycle Accounting and Reporting Standard, PAS 2050 and ISO/TS 14067.

Executive summary cont'd

Methodological issues addressed in these guidelines

Purpose of the study

The objectives of studies on avoided emissions can be grouped into two categories, according to where in the value chain they are focused:

1. Chemical product level: Quantify the extent to which a chemical product produces fewer emissions compared to an alternative chemical product or the chemical industry average.
2. End-use level: Assess the contribution of chemical products to emissions avoided by the use of a specific low-carbon technology that makes use of chemical products, compared with the technology or mix of technologies currently used or implemented.

Selection of the solution to compare

In order to calculate avoided emissions, the chemical product studied needs to be compared to a specific reference case or baseline, which has to deliver the same function to the user. Additionally, the baseline solution has to be an established product with a high market share (product level studies) or the weighted average based on shares of all currently implemented technologies affording the same user benefit (end-use level studies).

Simplified calculation methodology

Whenever possible, the full life cycle should be considered when calculating avoided emissions. However, if necessary, identical parts or processes in both life cycles may be omitted. Additional reporting requirements apply if this simplified calculation methodology is used.

Uncertainty of future developments

Assumptions about future conditions, such as how electricity used is generated, can considerably impact the amount of avoided emissions calculated. For products with a long use phase, the reporting company should undertake a qualitative scenario analysis taking into account alternative future developments. Or it may calculate an alternative scenario using a discount factor.

Attribution of avoided emissions among value chain partners

Life cycle avoided emissions almost always result from efforts of multiple partners along the value chain. This is particularly the case for a study at the end-use level. Criteria to categorize the significance of the contribution of chemical products to value chain avoided emissions as being *fundamental*, *extensive*, *substantial*, *minor* or *too small to communicate* are defined based on the function of the chemical product. Arguments for and against a quantitative attribution of avoided emissions among value chain partners are summarized. To support companies that see a compelling need to attribute part of the avoided emissions to the use of their products, we have developed a decision tree, which ensures that companies seek consensus with their partners along the value chain.

Reporting guidelines

To ensure that communication on avoided emissions is credible the following fundamental reporting guidelines are specified:

- Companies shall report the main results of the study of its own solution and of the comparative solution (the “solution to compare to”).
- Avoided emissions shall be presented as the difference between the two emission profiles, and differentiated by life cycle phase.
- Companies shall clearly state that the credit for the avoided emissions belongs to the complete value chain and shall describe their specific role in the value chain based on the functionality of their product.
- If trade-offs with other environmental impacts occur, the reporting company shall report on these environmental impact categories in the same way as it reports on GHG emissions and should consider not reporting avoided emissions at all.

The transparency of communication about results of avoided emissions studies is ensured by a number of further reporting requirements. These specify details of the report and include a reporting template.

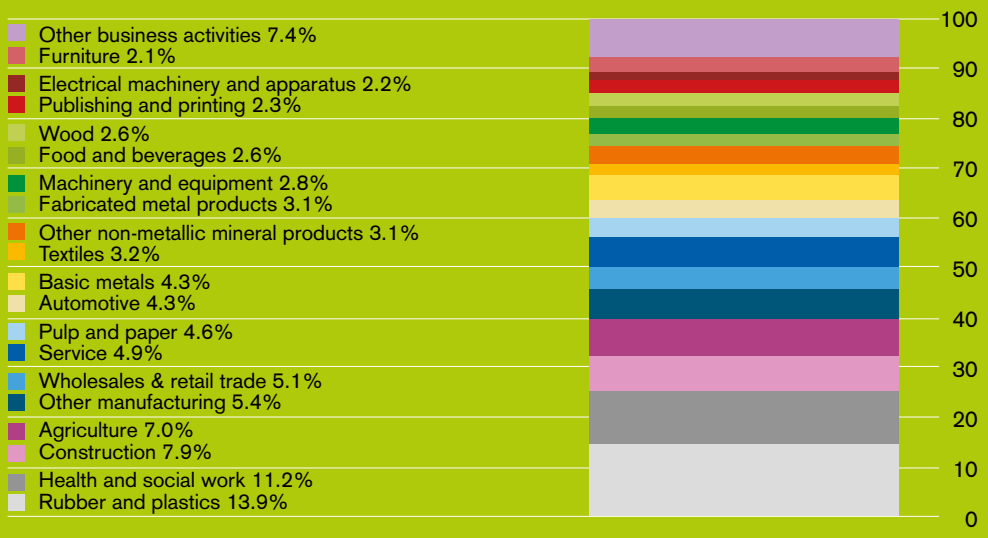
1. Introduction

1.1 Purpose of the guidelines

Today's world faces the challenge of climate change. The chemical industry is contributing to the reduction of greenhouse gas emissions by pursuing two complementary actions:

1. Reducing emissions in its own manufacturing facilities and supply chains, and
2. Developing innovative products that reduce emissions when used by other industries and consumers.

Figure 1. Customers of the EU chemical industry
(percentage of output consumed by customer sector)

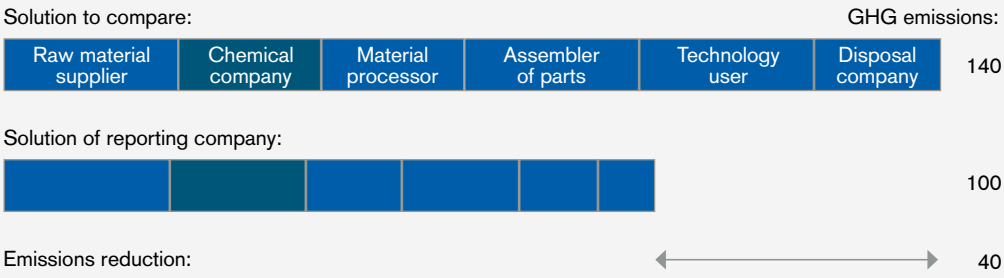


Sources: European Commission, Eurostat data (Input-Output 2000) and Cefic Analysis

The chemical industry is part of the life cycle of most everyday goods, as shown in Figure 1. This unique position offers the chemical industry opportunities to reduce greenhouse gas (GHG) emissions throughout society.

Many innovative chemical industry products enable GHG emission reductions downstream in the value chain, for example during the processing and manufacturing of downstream products, during use by the consumer or during end-of-life treatment (see Figure 2). The chemical industry contributes to greenhouse gas emission reductions throughout society, in collaboration with its value chain partners. Chemical companies seek to identify opportunities for further emission reductions and to communicate these opportunities to their customers and policy-makers.

Figure 2. A reduction in GHG emissions is the difference between the life cycle emissions from the solution of the reporting company and the solution it is compared to



To support these efforts, reliable and credible figures on greenhouse gas emission reductions enabled by chemical products are essential. But because many chemical products are intermediates, it is difficult to calculate emission reductions in the complete value chain, including downstream activities. As part of a value chain, chemical products assist emission reductions but are not solely responsible for them. That is why many leading chemical companies called for sector guidelines on calculating emission reductions enabled by chemical products.

This document provides guidelines on how to calculate emission reductions in value chains, by comparing two solutions with the same user benefit. In line with terminology chosen by the Greenhouse Gas Protocol, the difference in emissions between two alternative solutions will be termed “avoided emissions” in this document. The guidelines will help the chemical sector to communicate credibly to stakeholders the role of chemical products in reducing GHG emissions. The chemical industry hopes that other industries facing similar challenges may also benefit from these guidelines.

1.2 How the guidelines were developed

The guidelines were developed by the chemical sector task force of the World Business Council for Sustainable Development (WBCSD) and the International Council of Chemical Associations (ICCA) between July 2012 and June 2013. The task force drew upon existing Life Cycle Assessment (LCA) studies, company presentations, and expertise from participating chemical companies.

This document builds on internationally accepted standards and guidelines on LCA and carbon footprinting (see Section 1.4) and is therefore not a stand-alone document. Use of the terms "shall", "should" and "may" conforms to ISO/IEC directives (2011). For definitions of the terms see Annex B.

1.3 Who should use the guidelines

The guidelines have been developed for all chemical companies worldwide and for interested stakeholders. Companies that seek to measure, manage and communicate the avoided GHG emissions of their chemical products are encouraged to use this guidance document. Widespread use of these guidelines will increase the consistent calculation and communication of avoided emissions and make companies' findings more credible.

Results of avoided GHG emissions studies interest a wider audience, including chemical industry value chain partners and other stakeholders. This document could serve as a starting-point for conversations with value chain partners on how overall sustainability of product systems can be improved and communicated.

1.4 Relationship to existing standards and guidelines

This document builds on internationally accepted requirements and guidelines found in the ISO 14040 (1) and ISO 14044 (2) on LCA and is inspired by the Guideline for Calculating the Avoided CO_2 emission (2012) of the Japan Chemical Industry Association (JCIA). In addition, these guidelines aim to be consistent with leading standards and specifications on product carbon footprinting, including the GHG Protocol Product Life Cycle Accounting and Reporting Standard (2011), PAS2050 (2011), and ISO/TS 14067 (2013). The guidelines provide a step-by-step procedure to estimate the differences in GHG emissions between solutions. They focus on common challenges of LCA practitioners (people and organisations carrying out studies) in the chemical industry. In particular, they take into account the upstream position of chemical products in the value chain and provide a way to reliably quantify the effect a chemical product can have on environmental impacts of downstream activities. Accordingly, the guidelines go beyond existing standards. Table 1 gives an overview of the extra guidelines provided in this document compared to ISO 14040/44.

The chemical industry supports the multicriterial approach on which LCAs are based, as this ensures that studies show all aspects of the environmental impact (ICCA, 2013). To compare their products with alternative solutions, companies should perform a multicriterial LCA and check for possible trade-offs with other environmental impacts resulting from increased use of their low-carbon solutions (comparative assertion according to ISO 14040/44).

Table 1. Extra guidelines provided on accounting and reporting avoided emissions compared to ISO 14040/44

ISO 14040/44	Guidelines in this document
Goal and Scope definition	Purpose of study (Section 3.1) Selecting the level in the value chain (Section 3.1) Solution to compare (Section 3.2) Functional unit (Section 3.3) Boundary setting (Section 3.4.1)
Life Cycle Inventory (LCI)	Methods/formulas used (Section 3.4.2) Simplified calculation methodology (Section 3.4.3)
Life Cycle Impact Assessment (LCIA)	Methods/formulas used (Section 3.4.2)
Interpretation	Key parameters (Section 3.4.4) Integrating uncertainties and scenarios of future developments (Section 3.4.5)
-	Attribution of avoided emissions to value chain partners (Section 4)
Reporting	Reporting guidelines (Section 5)

If a full LCA[1] is not possible initially, companies may start with an analysis restricted to greenhouse gases as a first step. In this case, the reporting company shall check if trade-offs exist by doing a screening LCA[1]. If trade-offs are identified in the screening LCA, the reporting company shall report on these environmental impact categories in the same way as it reports on greenhouse gas emissions and should consider not reporting avoided emissions at all. If the analysis does not comply with ISO requirements, this shall be stated and the reasons shall be explained. In all aspects not specified in these guidelines, for example data quality requirements, companies shall follow the relevant ISO and GHG protocol standards.

1.5 Limitations of the guidelines in this document

The guidelines in this document should be regarded as a first global effort to develop consistent guidelines to account for and report avoided emissions. The guidelines note that chemical industry products are delivered to end-users through value chains and try to address value chain reporting issues, thereby avoiding multiple counting of avoided emissions. Fair reporting can only be achieved through coordination with value chain partners. We strongly welcome feedback on this document from value chain partners. It will help us update these guidelines to take into account the experience of companies and other organizations.

1. In general, a screening LCA takes all relevant impact categories into account, but uses more data from databases (secondary data) than life cycle specific data collected by the reporting company (primary data), compared to an ISO compatible LCA study.

2. Principles

This document adopts the five accounting principles of the GHG Protocol standards: relevance, completeness, consistency, transparency and accuracy. We have added a sixth principle, feasibility. The principles will guide users implementing the guidelines, especially when making choices that are not specified in this document.

Relevance

- Ensure the GHG inventories appropriately reflect the GHG emissions of the product and serve the decision-making needs of users – both internal and external to the company

Completeness

- Account for and report on all GHG emission sources and activities within the chosen inventory boundary
- Disclose and justify any specific exclusions

Consistency

- Use consistent methodologies to allow for meaningful comparisons of emissions over time
- Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series

Transparency

- Address all relevant issues in a factual and coherent manner, based on a clear audit trail
- Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used

Accuracy

- Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable
- Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information

Feasibility

- Ensure that the chosen approach can be executed within a reasonable timeframe and at reasonable effort / cost

3. Guidelines on accounting for avoided emissions

3.1 Purpose of study

In defining the purpose of the study, the following two items shall be clearly stated:

- The name and description of the organization(s) commissioning the study and that performing it ("the practitioner")
- The objectives of the study.

The objectives of studies on avoided emissions in the chemical industry can be grouped into two categories, based on the level in the value chain which the study focuses on (see also Figure 3):

1. Chemical product level: Measure the reduction in emissions generated by a product relative to an alternative (chemical) product or the industry average. Typical reasons for such calculations may be internal (e.g. product benchmarking) or to enable product differentiation for customers.
2. End-use level: Assess the contribution of chemical products to emissions avoided by the use of a certain low-carbon technology that makes use of chemical products instead of the currently implemented (mix of) technologies. Typical reasons for such calculations may be internal (e.g. portfolio planning), exchange with partners along the value chain or communication with other stakeholders including investors, policy makers or citizens about the role of the chemical industry.

The choice of objective has implications for key aspects of the calculation methodology, such as the definition of the functional unit.

Chemical product level

If the study is carried out at the chemical product level, the definition of the functional unit takes into account the performance of the chemical product and the alternative product. In this case the avoided emissions calculation is equal to the comparative assertion according to ISO 14040/44, except that the avoided emissions calculation focuses on greenhouse gas emissions only.

Examples for the definition of the functional unit in studies that focus on the chemical product level:

- Insulating 1 m^2 of an exterior wall using Expanded Polystyrene (EPS) versus stone wool achieving a U-value (wall) of 0.2 W/(m^2*K).

- Pack and preserve, with a rigid material, 400 g of chocolate drink powder during one year using PolyPropylene (PP) based on fossil versus biobased feedstock.

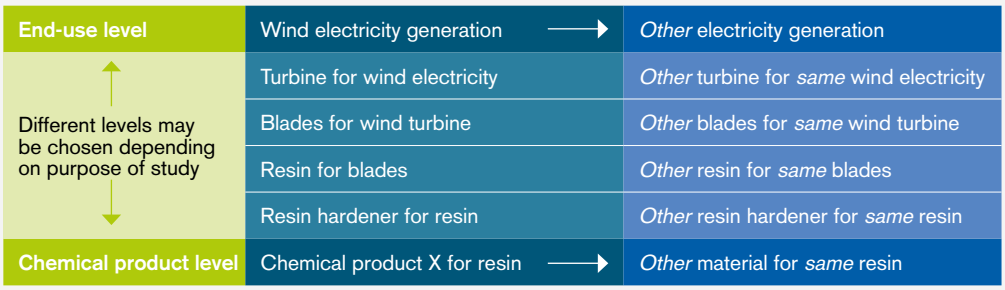
End-use level

Chemical products are often intermediate products integrated in technologies that are manufactured downstream in the value chain. Chemical products may influence the performance of technologies in such a way that emissions are avoided compared to a specific reference case. To assess how a chemical product influences an end-user technology, the functional unit of the study is chosen based on the end-use technology and taking into account the function of the chemical product in the technology.

Examples for definition of functional unit in studies that focus on the end-use level:

- Running a medium-sized gasoline automobile for 200,000 kilometres with fuel-efficient tires using special chemicals vs. regular tires.
- Living in an existing single-family detached house in Germany with an average temperature for 40 years (from 2011 to 2051), with polystyrene insulation and without.

Figure 3. Different levels in the value chain of wind electricity generation and relevant established alternatives that satisfy the same customer purpose at the respective level



The reporting company shall specify:

- What chemical product the study focuses on (e.g. resin hardener for a wind turbine blade, engineering plastic for a fuel tank, or Expanded Polystyrene (EPS) for wall insulation)
- What level in the value chain has been selected for the definition of the functional unit of the study (e.g. electricity, automobile, house = end-use level, or material for construction of wind turbine blade, bumper manufacturing, wall insulation = chemical product level), including the reason why this level has been chosen.

3.2 Solutions to compare

In order to calculate avoided emissions, the chemical product being studied needs to be compared to a certain reference case or baseline. The baseline shall meet a number of criteria to ensure a fair comparison of solutions (see also ISO 14044).

Solutions to compare (being compared) shall:

- Be at the same level in the value chain
- Deliver the same function to the user
  For example, if a customer requires energy with full-time availability (base load energy), the reporting company cannot compare wind energy with fossil-based energy as the alternatives are not exchangeable. The difference in performance between the alternatives may be resolved, for example by including a back-up gas turbine or storage batteries for the wind energy option to ensure continuous power availability.
- Be used in the same application
- Be distributed/used on the market, and not in the process of being banned, in the reference time period and geographic region. For the solutions to be compared at a specific level in the value chain this implies:
  - If the study is conducted at the chemical product level[2] any alternative established product(s) with a high (combined) market share, based on sales volume in the reference year, shall be used. A sufficiently high market share is normally considered to be 20% and above.
  - If the study is conducted at the end-use level[3], the weighted average based on shares of all currently implemented technologies for the same user benefit (including the studied end-use solution to which the chemical product contributes) shall be used.
- Be exchangeable for the typical customer in the selected market in terms of quality criteria (see Section 3.3.2)
- Be as consistent as possible with the solution of the reporting company in terms of data quality, methodology, assumptions etc.

2. Comparison at chemical product level: comparison of the life cycle GHG emissions of a chemical product and an alternative (chemical) product or industry average. This comparison is equal to the comparative assertion of ISO 14040/44, except that the avoided emissions calculation focuses on greenhouse gas emissions only.
3. Comparison at end-use level: comparison of end-user technology that integrates the upstream (chemical) product being studied and an alternative end-user technology or industry average.

Describing the solutions to compare:

- The reporting company shall clearly describe how the boundaries of the market and the application have been defined
- Both the solution of the reporting company and the solution it is compared to shall be described in similar levels of detail
- The description shall include the reference flow, i.e. the amount of the chemical product on which the result of the study is based
- The description shall discuss all aspects of all compared solutions which have a material impact on the emissions generated during the life cycle
- If the study is conducted at the end-use level, the description shall detail how the chemical product is used as part of the end-use application.

Case examples

Insulation material to refurbish existing houses

The study compares two alternatives for living in an existing detached house in Germany, one in which the house is left as it is and one in which the façade is refurbished using an External Thermal Insulation Composite System (ETICS) based on Expanded Polystyrene (EPS), a chemical industry product.

Light-weight automotive parts

The study compares a long glass fibre reinforced thermoplastic polypropylene (PP) used in an automotive front-end module (FEM) with a polyamide (PA)-steel hybrid FEM.

A number of case examples are published on ICCA website (http://www.icca-chem.org/Home/ICCA-publications/Publications-Search-Results/?topic=Climate+Change+and+Energy).

3.3 Functional unit

3.3.1 Function of the product/application

As in ISO 14040/44, a functional unit shall be defined to which all inputs and outputs of the product system can be related and which establishes equivalency between the products/applications under study. Companies shall specify and quantify the functional unit, taking the following aspects into account:

- The functional unit is defined as the performance characteristics and services delivered by the solutions being studied
- As the functional unit specifies the benefit provided to the customer, the functional unit shall be equivalent for all compared solutions
- To ensure the product is exchangeable for the typical customer in the selected market, relevant quality criteria shall be taken into consideration (see Section 3.3.2 for an overview of types of quality criteria)
- The functional unit shall be consistent with the goal and scope of the study.

3.3.2 Quality requirements

The following three quality properties should be used to assess whether compared solutions are truly exchangeable:

1. Functionality, related to the main function of the solution
2. Technical qualities, such as stability, durability, and ease of maintenance
3. Additional benefits rendered during use and disposal

3.3.3 Service life

- The reporting company shall specify the service life of the product or service in the functional unit, i.e. for how long the performance of the final product or service needs to be maintained. The service life is defined by the end-use application and may not be the same as the lifetime of the chemical product.
- The defined service life shall be in line with standards used in the market, e.g. product category rules, studies from reputable organizations, and studies by leading companies in the value chain.
- The reporting company shall clearly report the basis and justification for using the selected service life of the product or service.

3.3.4 Time and geographic reference

Companies shall specify the reference period chosen for the study. The reference period shall be a recent historic period to ensure both relevance of study results (not a period very long ago) and availability of actual data (not a future period). The typical duration of a reference period is one year.

If a company wants to study avoided emissions in a future year, it shall first calculate and report avoided emissions in a recent historic period. The reporting company shall explain the scenarios used to project the future (see Section 3.4.5).

Companies shall specify the geographic region chosen for the study. This includes the geographic region where the product is produced as well as where it is used. The reporting company should consider trade-offs that are relevant for the geographic regions chosen for the study, e.g. water depletion (see also Section 1.4).

3.4 Calculation methodology

3.4.1 Boundary setting

The reporting company shall describe the value chain steps of all solutions being compared:

- A flow diagram shall be provided to show the value chains for each of the solutions being compared. The reporting company should consider all activities from cradle to grave (see Section 3.4.3).
- A written description of the value chain shall be provided for clarification.
- The diagram shall indicate which parts of the value chain were assumed to be identical in the calculation of life cycle GHG emissions of the alternative solutions.

All system boundaries shall be explicitly mentioned in order to clarify what processes are excluded or included.

3.4.2 Methods/formulas used

The reporting company shall describe the method used to account for emissions at each step:

- For both solutions the life cycle GHG emissions shall be calculated in the same way according to existing standards
- The reporting company shall explain:
  - Its choices of methodology and standards used
  - Methods/formulas used to calculate the cradle-to-grave inventories.

All GHG emissions shall be converted to CO_2 equivalents according to IPCC (2007), over a 100 year time horizon.

3.4.3 Simplified calculation methodology

Whenever possible, the full life cycle should be considered when calculating avoided emissions, in order to comply with the requirements of ISO 14044[4]. However, when calculating avoided emissions, the solution of the reporting company and the solution to compare might have identical phases or processes in their life cycles. This is particularly the case for comparisons at the end-use level where, for example, the chemical product is part of an end-use solution with all other components being the same. While chemical companies have good knowledge of their own products and the impacts of these, it is often very difficult and extremely complicated to get reliable and precise data on other components of an end-use solution such as a house or an automobile.

4. ISO 14044 states: "The deletion of life cycle stages, processes, inputs or outputs is only permitted if it does not significantly change the overall conclusions of the study. Any decisions to omit life cycle stages, processes, inputs or outputs shall be clearly stated, and the reasons shall be explained."

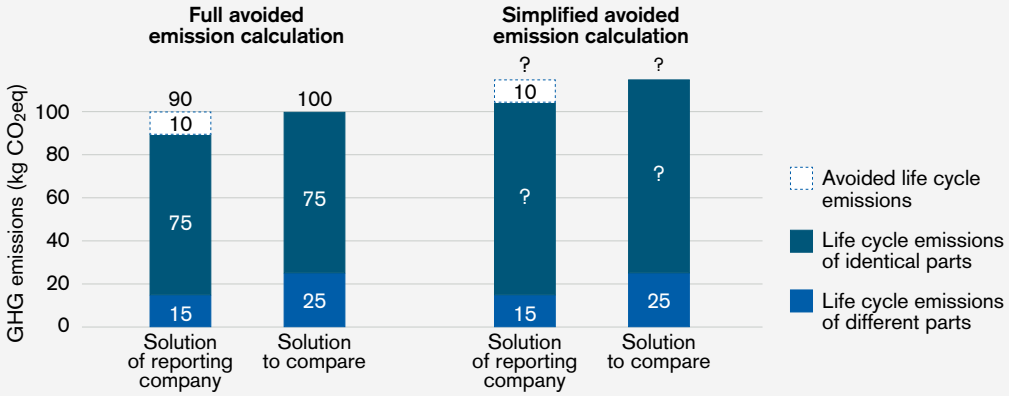
Identical parts or processes in the life cycle contribute equal amounts of greenhouse gas emissions to each solution and so do not affect the absolute amount of avoided emissions. If data is complex a simplified approach for calculating avoided emissions (referred to as “simplified calculation”) may be used which omits identical parts or processes in the life cycle of the products/solutions to be compared (see Figure 4). However, if a company decides to use simplified calculation these calculations might not be consistent with ISO 14044. The simplified approach takes into account the sixth accounting principle of this document, feasibility (see Section 2).

When a simplified calculation is used, the following additional reporting requirements shall be applied.

- The report shall say what parts are omitted and why.
- The report shall indicate the significance of the emissions being omitted relative to total emissions of the reference case preferably in a quantitative manner but at least in a qualitative manner.
- Data sources or assumptions used to estimate omitted emissions shall be reported.
- The report shall clearly and noticeably describe the limitations of the study arising from omitting identical processes. These might include change in the significance of life cycle phases or processes, increased uncertainties, etc. A reduction percentage, i.e. x% GHG emissions avoided in comparison to the reference solution, shall not be reported.

The significance of emissions omitted relative to total emissions of the reference case can be determined by basing estimates of omitted emissions on published LCAs or own estimates. If a quantitative estimate is made, results should be shown in a scenario analysis.

Figure 4. Illustration of simplified calculation. GHG emissions expressed in kg CO_2eq/functional unit



3.4.4 Key parameters

The reporting company shall specify which activities and parameters drive generation of GHG emissions. Examples are use of gasoline, service life of product, etc. Figures should be reported based on the results of sensitivity and uncertainty analysis.

3.4.5 Integrating uncertainties and scenarios of future developments

Upstream steps in the value chain of a manufactured chemical product can be calculated from existing data, since they have already taken place. But the use phase and end-of-life phase might extend several years into the future. User behaviour and end-of-life treatment might change in the future, impacting avoided emissions. Uncertainties over future conditions include, but are not limited to, changes in energy mix and energy efficiency, regulatory policies, market conditions, recycling practices, etc.

Since assumptions on future conditions can have a big impact on avoided emissions calculated, the reporting company shall first calculate a base case that assumes no future changes (i.e. use latest actual data). For products with a long use phase, for example more than ten years, the reporting company should provide a qualitative scenario analysis, explaining how each key parameter in the avoided emissions calculation might change in the future and how this influences the results. Instead of performing a qualitative scenario analysis, the reporting company may calculate one alternative scenario using a discount factor – a process similar to the use of discount factors in financial accounting.

Companies shall report the results of the base case and should report the scenario taking into account the most probable future changes.

4.

Attribution of avoided emissions to value chain partners

Life cycle avoided emissions almost always arise from efforts by multiple partners along the value chain. This is particularly the case for a study at end-use level. Avoided emissions are the sum of changes by all partners along the value chain, including raw material suppliers, material manufacturers such as chemical companies, material processors, part -assemblers and users of the technology, so avoided emissions cannot be attributed to one partner. **Therefore, avoided emissions calculated at the end-use level shall always be attributed to the complete value chain.**

4.1 Qualitative assessment of the contribution of a chemical product to value chain avoided emissions

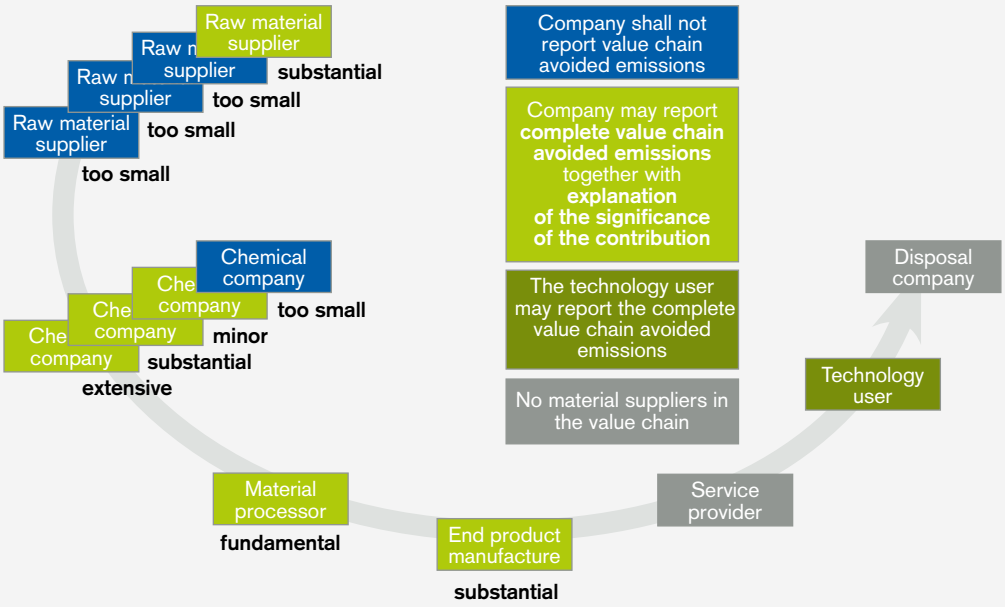
Individual partners in the value chain often wish to communicate the emissions avoided by the complete value chain. To increase the credibility of such statements, the reporting company must clarify its role in the value chain and refrain from reporting value chain avoided emissions if its own contribution is too small to communicate. Reporting companies shall use the schema presented in Table 2 to classify the contribution of their product to value chain avoided emissions. The schema classifies chemical products according to their contribution to avoiding GHG emissions (functionality approach).

Table 2. The significance of the contribution of chemical products to value chain avoided emissions based on the functionality approach

Significance of contribution	Relationship between chemical product and end-use solution
Fundamental	The chemical product is the key component that enables the GHG emission avoiding effect of the solution.
Extensive	The chemical product is part of the key component and its properties and functions are essential for enabling the GHG emission avoiding effect of the solution.
Substantial	The chemical product does not contribute directly to the avoided GHG emissions, but it cannot be substituted easily without changing the GHG emission avoiding effect of the solution.
Minor	The chemical product does not contribute directly to the avoided GHG emissions, but it is used in the manufacturing process of a fundamentally or extensively contributing product.
Too small to communicate	The chemical product can be substituted without changing the GHG avoiding effect of the solution.

Figure 5 illustrates the significance of the contribution of individual partners to avoided emissions in a typical low-carbon technology value chain. The contribution of service providers and disposal companies is not covered by this approach. The contribution of the technology user is slightly different from that of other value chain partners, since the user does not make a technological contribution but enables implementation of the technology by investing in and using it.

Figure 5. Communication on value chain avoided emissions by individual partners in a typical low-carbon technology value chain based on the functionality approach (see Table 2)



The reporting company shall report total emissions avoided along the complete value chain and shall report the significance of the contribution of its product to the end-use solution according to the functionality approach as presented in Table 2. In addition, the reporting company shall describe the specific role of its product in such a way that the reader understands how it is related to the GHG emission avoiding function of the end-use solution.

Example:
X million tonnes of emissions are avoided by using wind turbines backed by battery storage for power generation instead of the average European power production technology mix (grid mix). Company A makes two minor contributions to these avoided emissions by manufacturing resin components and coatings for the wind turbine blades.

Note that avoided emission figures referring to a complete value chain, to which the reporting company contributes, cannot be compared with emissions caused by the reporting company since the reporting boundaries are different. If the reporting company chooses to report the emissions associated with its activities (such as Scope 1 and Scope 2[5]), then the reporting company shall clearly state that the reporting boundaries for activity emissions are different from those of avoided emissions.

4.2 Pros and cons of attributing value chain avoided emissions to individual value chain partners

Companies may wish to quantify their contribution to emissions avoided by a complete value chain for reasons including:

- Transparency: Every player along the value chain may communicate on emissions avoided by the complete value chain. There is a risk of double counting, but this can be avoided if value chain partners agree how to attribute avoided emissions.
- Internal management: Companies increasingly compile detailed quantitative data on the emissions caused by their activities - within their corporate boundaries (scope 1) as well as along the value chain (scope 2 and scope 3) – to help them plan and control efforts to reduce emissions. Likewise they are looking for methodologies that help them quantify their role in emission avoiding value chains, to underpin the development of R&D and marketing strategies, as well as to develop performance targets and monitor their implementation.
- Comprehensive corporate external reporting: Companies often wish to present a true and fair picture of their overall impact on climate change. If the emissions caused by a company's activities are reported quantitatively, avoided emissions may be quantified and reported as well.
- Support understanding of value chains: External stakeholders including investors, policy makers and citizens are looking for reliable and comparable figures to understand and compare the role of different organizations in emission avoiding value chains.
- Communication of benefits of a whole industry sector: The chemical industry or other industry sectors may want to use avoided emission calculations to illustrate their contribution/benefits to society.
- Partners along the value chain, that make a contribution that is considered too small to report value chain avoided emissions, might want to report on their (small) individual share.

5. For Scope 1 and 2 definitions see GHG Protocol "A Corporate Accounting and Reporting Standard" (WRI and WBCSD, 2004)

However, important drawbacks of attributing avoided emissions to individual partners along the value chain have to be underlined:

- This may undermine understanding that implementation of low-carbon technologies is only possible through cooperation by different value chain partners.
- No single attribution method truly reflects the contribution of each value chain partner to the avoided emissions. Neither the physical characteristics of products, such as mass and volume, nor the price are proportionately correlated to the emission avoiding ability of a product. As a result, contributions of a partner may be over- or under-represented.
- Different attribution methodologies often lead to different avoided emissions results, with discrepancies being quite large in some cases. So figures for attributed avoided emissions quoted by different companies might not be comparable, but might be interpreted as if they are.
- If there is no agreement among value chain partners on how to attribute avoided emissions to individual partners, total attributed avoided emissions may be counted several times or do not add up to 100%.
- There is a reverse effect in economic as well as in physical attribution:
  For example, product improvements by individual companies that reduce material use whilst achieving the same functionality may result in less avoided emissions being attributed to this company.

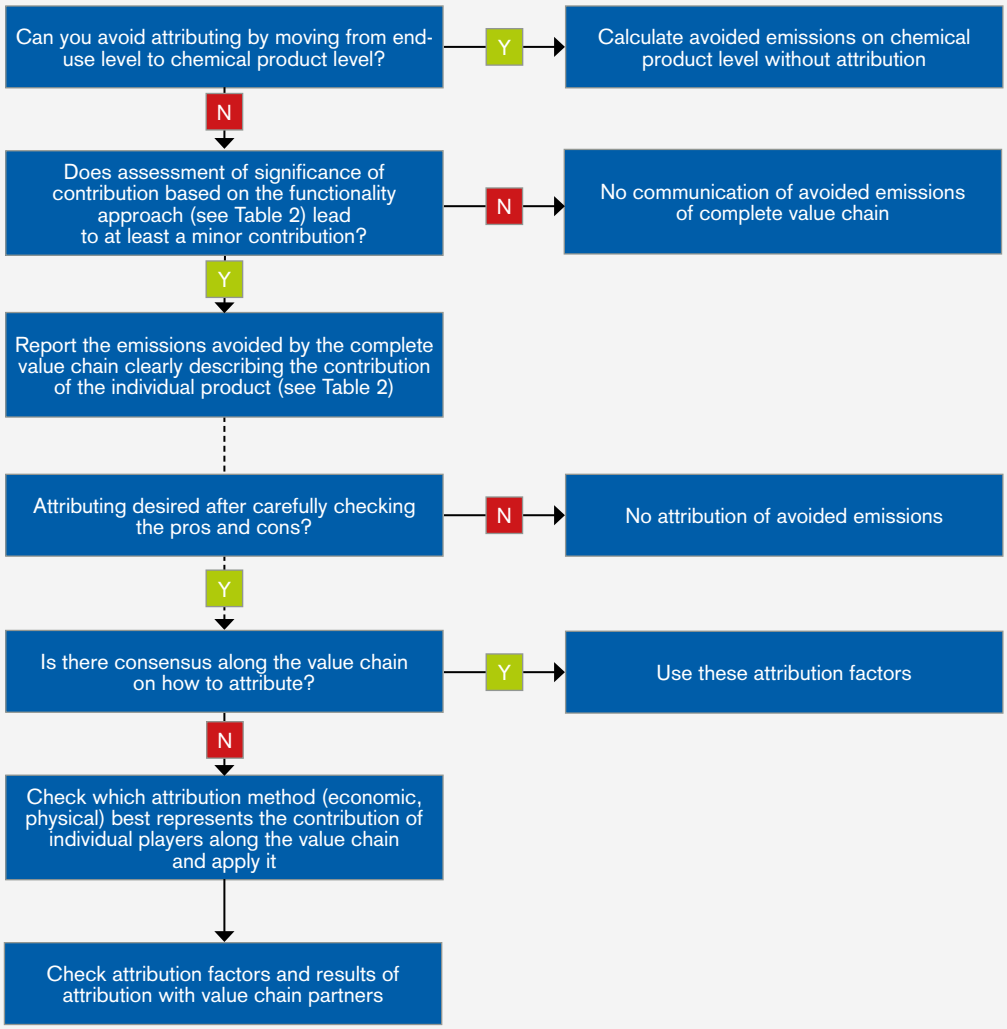
Given the ongoing debate on the advantages and disadvantages of attributing avoided emissions among value chain partners, **this document does not provide guidelines on quantitative attribution of avoided emissions**. However, to explore the possibilities of attributing avoided emissions to value chain partners and to offer companies a possible solution, the following section shows how avoided emissions could be attributed to value chain partners in a quantitative way.

4.3 Accounting and reporting of value chain avoided emissions by individual value chain partners

If companies see a compelling need to attribute a fraction of the avoided emissions to the use of their products, they should do so very transparently. They are recommended to follow well-defined steps and fully document the basis of their calculation. A proposed process is described below.

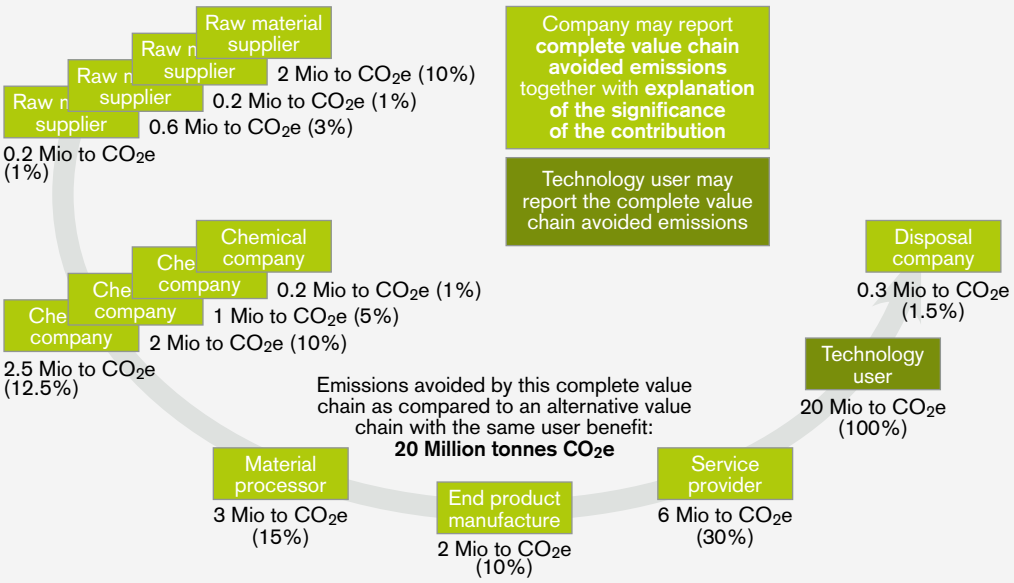
The reporting company is recommended to use the decision tree in Figure 6 when assessing and reporting avoided emissions to which several partners along the value chain contribute.

Figure 6. Decision tree to be used by companies when assessing and reporting avoided emissions



An example for the attribution of avoided emissions to value chain partners is given in Figure 7.

Figure 7. Communication on value chain avoided emissions by individual partners in the value chain based on attributing shares of the avoided emissions



When a reporting company applies attribution methodologies, it is recommended to address the following:

- Include all value chain partners that are addressed in the avoided emissions study (start from the defined user benefit and look upstream in the value chain to see which partners are needed to achieve the user benefit)
- If service providers are part of the value chain, attribution of emissions based on physical relationship is not possible
- In principle, avoided emissions attributed to a single company in the value chain can be compared with emissions caused by that company as the system boundaries are the same. However, since no prescriptive guidelines have been developed for attribution of avoided emissions among value chain partners, results may vary considerably. Companies are recommended to refrain from such comparisons.

The reporting company shall always report total emissions avoided along the complete value chain. It shall report on the significance of the contribution of its product to the end-use solution according to the functionality approach as presented in Table 2 in Section 4.1.

The reporting company may report figures for attributed avoided emissions as additional information. In that case, companies are recommended to clearly describe the applied attribution methodology and the reasoning underlying the attribution factors. When other value chain partners use a different attribution method, companies are recommended to include this method as a separate scenario.

The recommendations put forward in this section are a first attempt to provide guidance in quantifying avoided emissions attributable to individual value chain partners. The chemical industry intends to work with its value chain partners to further improve this approach and produce guidelines supported broadly by different stakeholders.

5. Reporting guidelines

Table 3 provides an overview of all reporting requirements that have been mentioned in previous sections. The reporting company shall comply with the requirements in Table 3 and additional reporting requirements as specified in this section.

Table 3. Overview of all reporting requirements from the previous sections

Section	Requirements
3.1 Purpose of study	• In defining the purpose of the study, the following two items shall be clearly stated: - The name and description of the organization(s) commissioning the study and the organization performing it. - The objectives of the study. • The reporting company shall specify: - What chemical product the study focuses on. - What level in the value chain has been selected to base the study on, including the reason why this level has been chosen.
3.2 Solutions to compare	Describing the solutions to compare: • The reporting company shall clearly describe how the boundaries of the market and the application have been defined. • Both the solution of the reporting company and the solution against which to compare shall be described in similar levels of detail. • The description shall include the reference flow, i.e. the amount of the chemical product on which the result of the study is based. • The description shall discuss all aspects of all compared solutions which have a material impact on the emissions generated during the life cycle. • If the study is conducted at end-use level, the description shall detail how the chemical product is used as part of the end-use application.
3.3.1 Function of the product/ application	• A functional unit shall be defined to which all inputs and outputs of the product system can be related and which establishes equivalency between the products/applications under study. • Companies shall specify the service life of the product or service in the functional unit, i.e. for how long the performance of the final product or service must be maintained. • The reporting company shall explain how the service life is determined.
3.3.3 Service life	• The reporting company shall specify the service life of the product or service in the functional unit. • The reporting company shall clearly report the basis and justification for the service life selected for the product or service.
3.3.4 Time and geographic reference	• Companies shall specify the reference period chosen for the study. • Companies shall specify the geographic region chosen for the study.
3.4.1 Boundary setting	• The reporting company shall describe the value chain steps of all solutions to compare: - A flow diagram shall be provided to describe the value chains for each of the solutions to compare. - A qualitative description of the value chain shall be provided for clarification. - The diagram shall indicate which parts of the value chain were assumed to be identical in the calculation of life cycle GHG emissions of the alternative solutions. • All system boundaries shall be explicitly mentioned in order to clarify what processes are excluded and included.
3.4.2 Methods/formulas used	• The reporting company shall provide transparency on: - Methodological choices made and standards used. - Methods/formulas used to calculate the full cradle-to-grave inventories.

Section	Requirements
3.4.3 Simplified calculation methodology	If the simplified calculation is used the following additional reporting requirements apply: • The report shall specify the omitted parts and the justification behind it. • The report shall give an indication of the significance of the emissions being omitted in relation to total emissions of the reference case preferably in a quantitative manner but at least in a qualitative manner. • Data sources or assumptions used to estimate omitted emissions shall be reported. • The report shall clearly and noticeably describe any limitations of the study arising from omitting identical processes such as change in the significance of life cycle phases or processes, greater uncertainties, etc. • Companies shall not report a reduction percentage, i.e. x % GHG emissions avoided in comparison to the reference solution.
3.4.4 Key parameters	• The reporting company shall specify which activities and parameters drive the generation of GHG emissions.
3.4.5 Integrating uncertainties and scenarios of future developments	• Companies shall report the results of the base case and should report the scenario taking into account future changes that are deemed most probable.
4.1 Qualitative assessment attribution	• The reporting company shall report on the significance of the contribution of its product to the end-use solution according to the functionality approach as presented in Table 2. • The reporting company shall describe the specific role of the product so that the reader understands how it is related to the GHG emission avoiding function of the end-use solution.
4.3 Accounting and reporting of value chain avoided emissions by individual value chain partners	• The reporting company shall always report the total emissions avoided along the complete value chain and shall describe its specific role in the value chain according to Table 2 in Section 4.1. • The reporting company may report figures for attributed avoided emissions as additional information. If so, companies are recommended to clearly describe the attribution methodology used and reasons for the attribution factors. When other value chain partners use a different attribution method, companies are recommended to include this method as a separate scenario.

Additional reporting requirements:

- Companies shall report the main results of the study for their own solution and for the solution to compare.
- The avoided emissions shall be presented as the difference between the two emission profiles, and differentiated by life cycle phase.
- Companies shall clearly state that the credit for the avoided emissions belongs to the complete value chain.
- Companies should report the full cradle-to-grave emissions of their own solution and full cradle-to-grave emissions of the solution(s) to compare. Companies should present the results of the study in a table to enhance clarity for external stakeholders (see Table 4). Additionally, companies are recommended to provide a graph of results (see Figure 8).
- The final result may additionally be communicated in terms of:
  - Total absolute avoided emissions
  - % emissions avoided compared to total emissions of the solution to compare. However, this way of presenting results is not allowed when the reporting company used the simplified calculation methodology.
- The reporting company shall finalize the report with an overview of:
  - Conclusions and implications from the study
  - Additional steps/updates that might be planned to improve the results of its study
- Appendices may be included to provide:
  - Additional information on sources used
  - Results from the critical review
  - A glossary

Figure 8. Avoided emissions are the difference between the cradle-to-grave emissions from the solution of the reporting company and those of the solution to compare

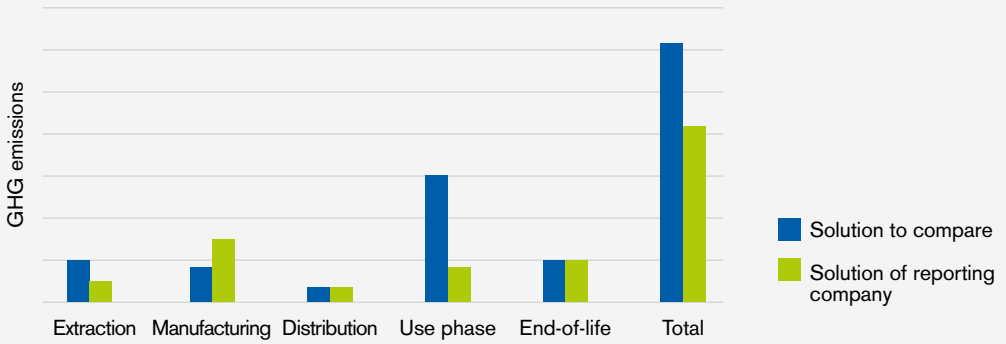


Table 4. Example of a table presenting all results of a study on avoided emissions

Emissions per phase (CO_2e)	Reporting company's solution	Solution to compare to
Raw material extraction		
Manufacturing / processing		
Distribution		
Use phase		
End of life		
Total emissions	**P1**	**P2**
Avoided emissions	**= P2 - P1**	

Public disclosure of LCA comparative assertions requires critical review by a panel in order to comply with ISO 14044. For avoided emissions studies, companies are strongly recommended to be consistent with ISO 14044. The critical review process and status shall be clearly reported.

Annex A contains a proposed reporting template for avoided emissions studies.

6. Annexes

Annex A. Report template

TITLE of Study
Commissioner and performer of the study

Sections to be included:

1. **Purpose of Study**
   [explanation of the objective and goal of the study; the methodology used (ICCA-WBCSD Avoided Emissions Guidelines) and other relevant high-level information]

2. **Level in the Value Chain**
   [Indicate the level in the value chain at which the study is performed]

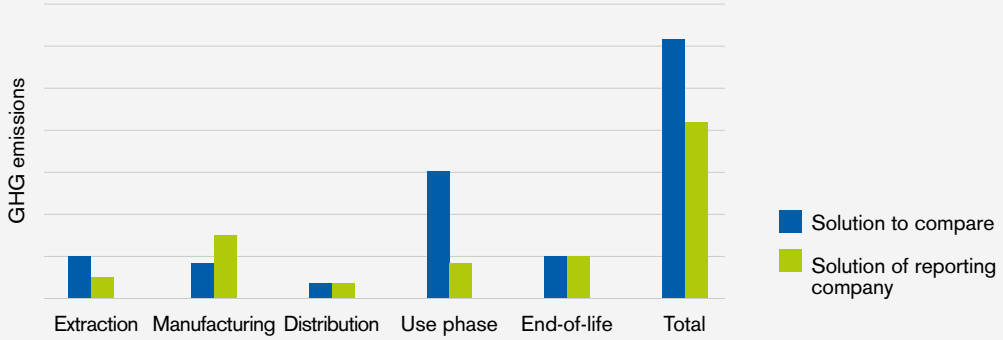
3. **Solutions to Compare**
   [indicate what solutions are being compared and provide relevant information about each solution]

4. **Functional Unit**
   - 4.1 Description of the Function and the Functional Unit
     [describe the function and functional unit of the product]
   - 4.2 Quality Requirements
     [indicate any quality criteria that are taken into consideration to ensure compared products are exchangeable for the typical customer in the selected market]
   - 4.3 Service Life
     [Indicate service life of product taken into consideration]
   - 4.4 Time and Geographic Reference
     [indicate the time and geographic reference]

5. **Calculation Methodology**
   [indicate any relevant general information related to calculation methodology; and specific information about databases used; data quality; methods/formulas used; Scenarios; and key parameters]

6. Results

[indicate study results from compared solutions with figures, tables, descriptions, etc]



Emissions per phase (CO_2e)	Reporting company's solution	Solution to compare to
Raw material extraction	.....	.....
Manufacturing / processing	.....	.....
Distribution	.....	.....
Use phase	.....	.....
End of life	.....	.....
Total emissions	**P1**	**P2**
Avoided emissions	**= P2 - P1**	

7. Significance of Contribution

[describe the significance of the contribution of the studied product to overall value chain avoided emissions]

8. Attribution

[describe attribution methods, if they are used in study]

9. Review of Results

[indicate any review of the results that were undertaken and which standard was followed]

10. Scenario Analysis

[indicate results from scenario analysis]

11. Study Limitations and Future Recommendations

[describe any limitations of the study or improvements/recommendations for future revisions of the study]

12. References

[list any relevant references]

Annex B. Glossary

Attribution
Dividing up avoided greenhouse gas emissions among the different partners in a low-carbon technology value chain.

Chemical product
The chemical product is the product sold by the reporting company.

Functional unit
Functional unit is the quantified performance of a product system for use as a reference unit (ISO 14044, 2006).

May
The term “may” is used in this document to indicate a course of action permissible within the limits of the document. (ISO/IEC, 2011).

Shall
The term “shall” is used in this document to indicate requirements strictly to be followed in order to conform to the guidelines in this document and from which no deviation is permitted. (ISO/IEC, 2011).

Should
The term “should” is used in this document to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited. (ISO/IEC, 2011).

Reporting company’s solution
Depending on the level of the value chain at which the study is conducted, this can be the chemical product the reporting company sells or an intermediate product/the end-use level containing the chemical product.

Solution
Any product that is sold along the value chain, a chemical product, a material from another industry, a component or a final technology.

Solution to compare to
The alternative solution providing the same benefit to the customer as the reporting company`s solution.

PAS
Publicly Available Specification.

Annex C. References

1. ICCA (2013). How to Know If and When it's Time to Commission a Life Cycle Assessment – An Executive Guide.

2. ISO 14040 (2006). Environmental management – Life cycle assessment – Principles and framework.

3. ISO 14044 (2006). Environmental management – Life cycle assessment – Requirements and guidelines.

4. ISO/TS 14067 (2013). Greenhouse gases - Carbon footprint of products – Requirements and guidelines for quantification and communication.

5. ISO/IEC, 2011. ISO/IEC Directives Part 2. Edition 6.0 2011-04. Rules for the structure and drafting of International Standards.
   ISO: International Organization for Standardization
   IEC: International Electrotechnical Commission.

6. Japan Chemical Industry Association (2012). Guideline for Calculating the Avoided CO_2 Emission.

7 British Standards (2011). PAS 2050: Specification for the assessment of the life cycle greenhouse gas emissions of goods and services.

8. WRI/WBCSD (2004). GHG Protocol: A Corporate Accounting and Reporting Standard.

9. WRI/WBCSD (2011). GHG Protocol: Product life cycle accounting and reporting standard.

About the International Council of Chemical Associations (ICCA)

The International Council of Chemical Associations (ICCA) is the worldwide voice of the chemical industry, representing chemical manufacturers and producers all over the world. Responding to the need for a global presence, ICCA was created in 1989 to coordinate the work of chemical companies and associations on issues and programs of international interest. It comprises trade associations representing companies involved in all aspects of the chemical industry.
ICCA is a chemical industry sector with 2011 turnover of just under 3,000 billion euros. ICCA members (incl. observers & Responsible Care members) account for more than 90 percent of global chemical sales.
ICCA promotes and co-ordinates Responsible Care® and other voluntary chemical industry initiatives. ICCA has a central role in the exchange of information within the international industry, and in the development of position statements on matters of policy. It is also the main channel of communication between the industry and various international organizations that are concerned with health, environment and trade-related issues, including the United Nations Environment Programme (UNEP), the World Trade Organization (WTO) and the Organisation for Economic Co-operation & Development (OECD).
ICCA operates by coordinating the work of member associations and their member companies, through the exchange of information and the development of common positions on policy issues of international significance.
Three main issues focused on by ICCA are: Chemicals Policy & Health, Climate Change & Energy, Responsible Care®
ICCA also serves as the main channel of communication between the industry and various international entities, such as inter-governmental organizations (IGOs) and NGOs that are concerned with these global issues.

www.icca-chem.org

About the World Business Council for Sustainable Development (WBCSD)

The World Business Council for Sustainable Development is a CEO-led organization of forward-thinking companies that galvanizes the global business community to create a sustainable future for business, society and the environment. Together with its members, the Council applies its respected thought leadership and effective advocacy to generate constructive solutions and take shared action. Leveraging its strong relationships with stakeholders as the leading advocate for business, the Council helps drive debate and policy change in favor of sustainable development solutions.
The WBCSD provides a forum for its 200 member companies - who represent all business sectors, all continents and a combined revenue of more than $7 trillion - to share best practices on sustainable development issues and to develop innovative tools that change the status quo. The Council also benefits from a network of 60 national and regional business councils and partner organizations, a majority of which are based in developing countries.

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