



Guidance for Accounting & Reporting Corporate GHG Emissions in the Chemical Sector Value Chain



wbcsd chemicals

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There is growing awareness about the impact that a changing climate has on companies and value chains. Policies and regulations on climate change are becoming more stringent; companies are experiencing fluctuating and higher energy costs; and business is facing increasing requests to respond to stakeholder demands for more information on corporate impacts.

Businesses at the forefront of this understanding often find that the majority of impacts go beyond the traditional corporate fence. Companies are not only addressing these climate issues but are finding real business value in accounting, managing and reporting in this key sustainability area. In the WBCSD Chemical Sector Greenhouse Gas (GHG) Working Group we have found that corporate action on climate change provides the opportunity for business to address energy use, identify efficiency gains, develop new products, and find new market opportunities that can positively impact the bottom line.

Our Working Group has proactively developed sector guidance for a harmonized approach for accounting and reporting value chain GHG emissions for chemical companies. This guidance document is based on leading global practice - the Greenhouse Gas Protocol standards, which are developed through a global stakeholder process led by the World Resources Institute (WRI) and WBCSD.

It is our aim that this work will be a step towards guiding more chemical companies around the world to accounting, reporting and managing their climate impacts. Not only will this lead to more consistent and credible communication of our GHG emissions to our stakeholders, but will create real business opportunities along the way. With this first version of the guidance document, we want to engage and discuss with stakeholders and industry peers. Through this, we can build upon the experience of our working group and further improve our industry's response to addressing climate change.

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About this document

This document provides guidance to support chemical companies in the consistent accounting and reporting of greenhouse gas (GHG) emissions, including the company's own emissions and those of its value chain¹.

The guidance builds upon existing best practice standards for corporate GHG accounting and reporting – The GHG Protocol Standards – which are developed through a global, multi-stakeholder process convened by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI).

In following internationally-recognized GHG standards, wide variations exist in the resulting emissions amounts reported, due to the allowable choices made through the GHG inventory process. This document addresses the areas where the most inconsistency in approaches by reporting companies was found, including how to account for and report emissions related to: joint arrangements; the resale of energy; identifying relevant value chain (scope 3) activities; combined heat and power installations; renewable sources; swapping arrangements; and offsets and unbundled energy certificates. The guidance also provides a consistent framework for reporting.

The use of this guidance, along with the GHG Protocol Standards, is intended to create more consistency and comparability in the GHG accounting, reporting and performance assessment of chemical companies, further supporting the efforts of WBCSD chemical companies in the key sustainability area of GHG management.

HOW IT WAS DEVELOPED

The report is the result of a collaborative process among ten global chemical companies that are members of the WBCSD. These companies formed a working group that met over fifteen months and cooperatively developed sector guidance to improve harmonization and consistency for GHG accounting and reporting.

The working group was co-chaired by AkzoNobel, BASF, and Solvay. Working group members included DSM, DuPont, Evonik, Mitsubishi Chemical Holding, Sabic, The Dow Chemical Company, and Umicore. The working group was supported by Arthur D. Little.

HOW IT WILL BE UPDATED IN FUTURE

This guidance is a first approach for a common sector guide for corporate-level GHG accounting and reporting. It is hoped that companies across the industry will use this guide and find it valuable when undertaking their own GHG inventory process. As experience in the use of this guide grows, the document will be updated, based on the feedback from participating companies and other stakeholders and organizations.

1. This document uses the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard's definition of "value chain", which is referenced in Appendix C, Terms and Definitions.

1 Introduction

CORPORATE GHG EMISSIONS

This document provides further guidance for chemical companies to account for and report their corporate emissions using the globally accepted GHG Protocol standards.

The GHG Protocol standards consist of a suite of standards to guide companies in accounting and reporting emissions from corporate activities, including the Corporate Accounting and Reporting Standard (Corporate Standard), Product Life Cycle Accounting and Reporting Standard (Product Standard) and the Corporate Value Chain (Scope

3) Accounting and Reporting Standard (Scope 3 Standard).

The **GHG Protocol Corporate Accounting and Reporting Standard (Corporate Standard)** provides a standardized methodology for companies to measure and report their corporate GHG emissions. The Corporate Standard provides requirements and guidance for scope 1 and scope 2, and gives flexibility in whether and how to account for and report scope 3 emissions.

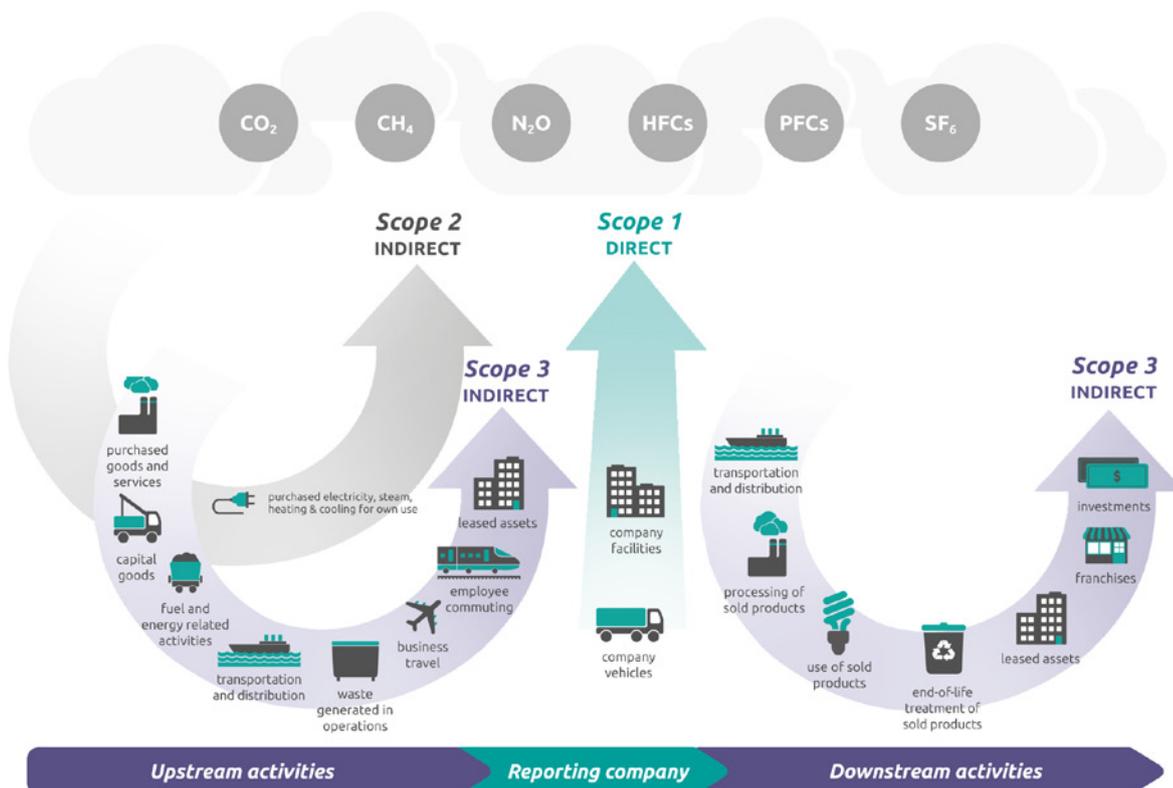
The **GHG Protocol Corporate Value Chain (Scope 3) Standard (Scope 3 Standard)** helps companies measure GHG emissions across the entire value chain, identify reduction opportunities,

track performance, and engage suppliers in GHG management activities. The standard is a supplement to the GHG Protocol Corporate Standard and should be used with it to measure and report a company's emissions from chain activities.

More detailed information and a description of corporate emissions, as well as the requirements and guidance for full value chain accounting and reporting, can be found in the GHG Protocol Corporate Accounting and Reporting Standard, and the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard. More information on the standards is available at www.ghgprotocol.org.

Figure 1 Overview of Corporate Emissions

Source: GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard



EMISSIONS TYPE	SCOPE	DEFINITION
Direct emissions	Scope 1	Emissions from operations that are owned or controlled by the reporting company.
Indirect Emissions	Scope 2	Emissions from the generation of purchased or acquired energy such as electricity, steam, heating or cooling, consumed by the reporting company.
Indirect Emissions	Scope 3	All other indirect emissions that occur in the value chain of the reporting company, including both upstream and downstream emissions.

Source: GHG Protocol

HOW TO USE WITH GHG PROTOCOL

While this document is not endorsed by the GHG Protocol, it is based on the GHG Protocol standards and they should be used as the basis for developing corporate GHG inventories. It is intended to be used alongside the GHG Protocol standards to further assist companies in the chemical sector when undertaking their corporate scope 1,2 and 3 accounting and reporting.

SCOPE OF GUIDANCE DOCUMENT

The document focuses on a number of issues that chemical companies must address when preparing facility-level or company-level inventories. It includes guidance for relevant scope 1, 2 and 3 emissions occurring in a historical year period (e.g. calendar year or fiscal year)

directly or indirectly from chemical companies. While this guidance focuses on the accounting and reporting of GHG emissions of the value chain of a company it does also contain relevant guidance for the reporting from the life cycle from one product.

The guidance is intended to support the implementation of the globally recognized GHG Protocol standards, and therefore company inventories shall include emissions from all six Kyoto gases: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆). The guidance can also be applied to non-Kyoto GHG emissions.

The guidance does not address the quantification of avoided emissions through the use of a company's products.

It is recognized that the implementation of this guidance is a gradual process which may take several years to fully meet all requirements. Implementation may require companies to undertake actions such as:

- Update data gathering methods throughout organizational units and affiliate companies;
- Update contracts with third parties to allow for sharing of data on GHG emissions.

Specific operational circumstances may require companies to diverge from the guidance in this document. Companies that diverge from the best-practice guidance provided in this document shall explicitly clarify and report the reasons for diverging.

Reporting in conformance with this document may result in inconsistencies with local reporting, as the local reporting may have to comply with regulations that require specific methods and/or emission factors.

TERMINOLOGY (USE OF SHALL SHOULD MAY)

This document utilizes precise language recognized in standards such as the GHG Protocol standards and International Organization for Standardization (ISO) standards to indicate actions that are required, recommended or optional. Therefore, the use of “shall” in this guidance indicates a specific required action for a reporting company to conform to this guidance. The use of “should” indicates a recommended action, but is not a requirement. The use of “may” is a permissible or optional action for a reporting company in their inventory process.

STRUCTURE OF GUIDANCE (SUMMARY OF STEPS)

There are six main sections of this document, listed below, to help chemical sector companies develop corporate-level GHG inventories.

1. Introduction
2. Setting the boundaries of the GHG inventory
3. Collecting data and calculating GHG emissions
4. Allocating GHG emissions
5. Reporting GHG emissions
6. Appendix and Glossary

Each methodological section addresses a number of relevant topics for the chemical industry accompanied by case examples and detailed guidance on the respective topics.

Setting GHG inventory boundaries

Establishing boundaries requires companies to determine which activities that give rise to emissions should be included in the inventory. While companies should always refer to the GHG Protocol standards to understand the general requirements and guidance for setting organizational and operational boundaries, the flexibility it provides results in different approaches used to set boundaries for the reporting of scope 1, 2 and 3 emissions. This results in varying degrees of consistency and comparability of GHG emissions information.

This guidance provides additional clarification for chemical sector companies when setting boundaries to balance completeness and consistency with relevance of emissions activities. Furthermore, the use of a common approach for the chemical sector will significantly improve consistency across the GHG inventories of chemical companies.

THE ISSUES ADDRESSED IN THIS SECTION INCLUDE:

1. Setting boundaries for:
 - o Joint arrangements
 - o Upstream Fuel- and Energy-related emissions
 - o Purchase, sale and resale of energy
2. Identifying the Scope 3 activities relevant for chemical companies to account for and report

SUMMARY OF GUIDANCE IN THIS SECTION:

- Companies shall bring GHG accounting for joint arrangements in-line with financial consolidation (see Section 2.1).
- Upstream emissions from fuel and energy-related activities not included in scope 1 or 2 shall be reported in scope 3, category 3 (see Section 2.2).
- Companies shall net energy purchases with sales of self-generated energy on a site basis and over the time-frame of a year and report net energy purchases under scope 2. Emissions from the generation of purchased energy that is resold may be reported under scope 3, category 3 (see Section 2.3).
- Companies shall account for and report emissions from the scope 3 categories identified below (see Section 2.4):

- o All Upstream scope 3 categories as defined by the GHG Protocol Scope 3 Standard;
- o Downstream scope 3 category 9 (Downstream transportation

and distribution); category 11 (Use of sold products – only direct emissions); category 12 (End-of-life emissions); and category 15 (Investments – only material equity investments);

- Category 10 (Processing of sold products) may be relevant for some chemical companies, however the diversity of applications generally cannot be reasonably tracked. Therefore, at this time category 10 is not required, however if companies can account for these emissions, they should include them in their inventory.
- Other categories were found to be not applicable or not relevant for chemical companies, but should be periodically assessed for relevance every three years.

2.1 Joint Arrangements

Joint arrangements are when two or more companies jointly own or are responsible for a company's operations. While this is not an issue only for chemical companies, the guidance in this section is intended to clarify how to account for and report emissions related to joint operations, joint ventures and joint responsibility of operations – a frequent challenge for companies within the chemical industry.

While the Greenhouse Gas Protocol offers different approaches, this guidance specifies the approach that shall be used in order to increase consistency of reporting within the chemical sector. Following the approach identified in this guidance may have a large impact on total emissions reported.

GUIDANCE:

Companies shall bring GHG accounting in line with financial consolidation; companies account for GHG emissions, according to the extent the activity or asset is included in the financial consolidation for calculating the revenue (i.e. either equity share, financial control or operational control).

RATIONALE FOR GUIDANCE:

By aligning the financial boundary and the GHG emissions boundary for joint arrangements (also called joint-ventures or JVs), this approach ensures internal consistency of GHG information with reported revenue.

With the new International Financial Reporting Standards (IFRS) on consolidated financial statements in effect on January 1, 2013, companies will automatically converge towards a more prescriptive approach on financial reporting. The IFRS also aims to converge with the United States Generally Accepted Accounting Principles (GAAP), thereby laying the framework for globally-accepted approach to financial reporting on consolidated financial statements. Participating companies indicated a strong interest to align GHG reporting with financial reporting, as it enables prioritization of GHG management activities through the use of aligned economic and GHG data.

The alignment of financial and GHG emissions reporting also is in-line with emerging practices in companies of integrated reporting, and reporting programs and organizations such as

the Climate Disclosure Standards Board (CDSB). It also enables the transition towards integrating the reporting of financial and non-financial information relevant for investors, which is an emerging practice among many companies.

It is important to recognize that the implementation of this best practice guidance will take several years as it may be necessary to update joint-venture (JV) contracts to obtain relevant GHG emissions data for completing the inventory for companies involved in the joint arrangement.

ADDITIONAL GUIDANCE FOR APPLYING THE RECOMMENDED APPROACH:

Companies shall follow the chosen approach for financial consolidation. For example, if a JV-company is fully consolidated in the reported revenue figure, its scope 1, 2 and 3 emissions shall also be fully consolidated in the corporate emissions inventory.

All scope 1 and 2 emissions of non-consolidated investments of which companies hold a minimum interest of 20% shall be reported under scope 3, category 15 "Investments" (see Figure 2).

Companies that indicate the income which is generated by minority interests in their financial reports may additionally report on emissions generated by these minority interests to enable comparison with financials based on the same scope. If so, companies report these emissions in Scope 3, category 15.

Figure 2 Reporting of non-consolidated investments

Description of example situation		Implication for reporting on GHG emissions		
	Description of joint arrangement	Financial consolidation	Report in scope 1/2 (following consolidated affiliate revenues)	Report in scope 3 - Investments
1	Company owns 100% of shares of affiliate	100% of affiliate revenues	100%	0%
2	50/50 Joint Venture	100% of affiliate revenues	100%	0%
3	50/50 Joint Venture	0% of affiliate revenues	0%	50%
4	50/50 Joint Venture	50% of affiliate revenues	50%	0%
5	20% interest	0% of affiliate revenues	0%	20%
6	3% interest	0% of affiliate revenues	0%	0%

2.2 Upstream Fuel- and Energy-related emissions

This topic is considered important for the reporting of GHG emissions from the chemical industry because the different approaches can create confusion among users of reported GHG data, create discrepancies in the scopes of GHG data, and will increase the lack of comparability across GHG inventories.

The GHG Protocol Scope 3 Standard includes Category 3 Fuel-and Energy-Related activities (not included in scope 1 or 2). This category includes emissions from all upstream extraction, production and transportation of fuels and energy purchased by the company that are not included already in scope 1 or 2.

GUIDANCE

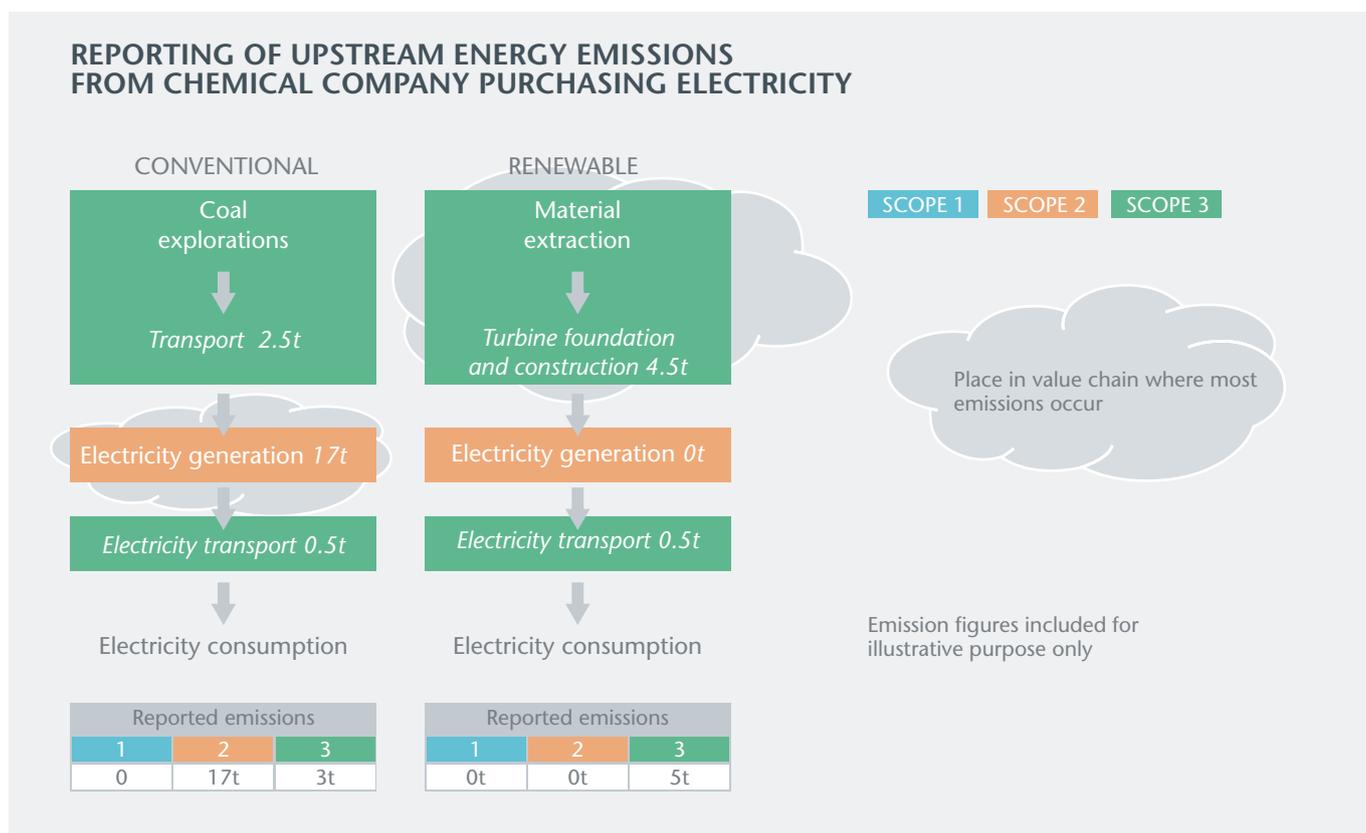
Companies shall report under scope 3, category 3, all upstream emissions from fuels purchased for on-site generation of energy and from purchased energy consumed by the company.

This category does not include fuels that are purchased and used as input materials and/or feedstocks that are used to produce raw materials, which are included in Category 1, Purchased Goods and Services.

RATIONALE FOR GUIDANCE

The approach was selected due to its consistency with the GHG Protocol standards, and existing reporting practices. For fossil fuels, emissions are typically generated during the

combustion of fuels during electricity generation. For renewable electricity, the emissions are typically generated during the material extraction and production of the generation device (e.g. turbines). Some companies favor the inclusion of upstream scope 3 emissions in scope 2 emissions, as this would make it easier to compare alternative fuels within only one scope. However, this practice would result in inconsistencies across company inventories, as the definition of scope 2 emissions does not include upstream emissions from extraction, production and transportation of purchased energy. In addition, it may create inconsistencies with reports from companies in other industries, as the reporting of scope 3 upstream emissions in scope 3 follows the GHG Protocol standards.



2.3 Resale of Energy

Many chemical companies both purchase and sell energy. It is unclear to many chemical companies how to account and report the GHG emissions related to these activities, for example:

- Whether to net purchases and sales;
- What emissions factors to apply;
- In what scope to report emissions.

GUIDANCE:

Companies shall net energy purchases with sales of energy (for example, self-generated energy) on a site basis and over the time-frame of a year and shall report net energy purchases under scope 2.

RATIONALE FOR GUIDANCE:

The implementation of this guidance will avoid double counting of emissions within a company's inventory. Furthermore it will provide a fair and representative accounting of emissions caused by the use of energy in the production of chemicals.

ADDITIONAL GUIDANCE FOR APPLYING THE SELECTED APPROACH:

- Companies shall calculate separate inventories to account for the different types of energy (e.g. steam and electricity) and shall not perform netting calculations across different types of energy.
- While the guidance on the following pages refers to electricity, the guidance is equally applicable to steam.

- All emissions caused by generation of electricity within the operating boundaries of the company shall be reported as scope 1 emissions, irrespective of whether the generated electricity is used by the company itself or sold to a third party.
- Reporting or calculating with annual negative scope 2 emissions on a site or corporate level is not allowed. When emissions are calculated for intermediate periods, companies may report negative scope 2 emissions to maintain consistency with annual figures.
- When purchased electricity is not consumed but resold by the reporting company to an end user, it shall not be included in the scope 2 emissions of the reporting company; it shall be reported under scope 3, category 3.
- Companies shall keep track of any specific energy purchases and/or sales to calculate emissions factors required for reporting.
- When reporting energy sales from a specific source to a customer, the reported emission factor shall be in line with the contractual agreement with this customer.
- Chemical companies shall follow a 3-step approach to calculate emissions related to the generation, purchase and resale of electricity, as illustrated below.

GENERAL GUIDANCE

- 100% of emissions from electricity² generated, whether by the

reporting company or from additional electricity purchased to run operations, shall be reported in either scope 1, scope 2 or scope 3 to avoid over counting or under counting.

- Companies shall separately account for different energy types (e.g. electricity, steam).

STEP 1: IDENTIFY SCOPE 1 EMISSIONS

- All emissions from electricity generated on-site shall be reported as scope 1 emissions

STEP 2: CALCULATE SCOPE 2 EMISSIONS

- Any purchased electricity not consumed by the reporting company, but resold to third parties, shall not be included in scope 2 emissions (see Case Example A below).

² Guidance is also valid for other forms of energy, such as steam.

- Scope 2 emissions shall be calculated on a site-level by taking the yearly amount of emissions from the generation of purchased electricity that is consumed in the company's owned or controlled equipment (P), exclusive of the amount of emissions associated with or self-generated electricity sold to third parties (end-user or the grid) (S). If $S > P$, no scope 2 emissions shall be reported for this site. Negative scope 2 emissions on a yearly basis are not possible.
- Unless contractual agreements specify the origin of the sold electricity, it is assumed that electricity is supplied from purchased sources³.
- The weighted average emission factor of purchased electricity used for reporting under scope 2 should not include any emissions from electricity resold to end users.

- Companies may report negative scope 2 emissions when calculating scope 2 emissions for intermediate periods of less than one year⁴, although negative emissions due to netting procedures are not allowed in yearly calculations and reporting on site and corporate level.
- If scope 1 and 2 GHG intensities for the production of chemicals are reported, companies shall subtract scope 1 emissions related to generated electricity that is sold to avoid undesirable distortions or inconsistencies from occurring in reported information.

STEP 3: CALCULATE SCOPE 3 EMISSIONS

- Scope 3 emissions reflect emissions from electricity sold to end users, which have not yet been reported

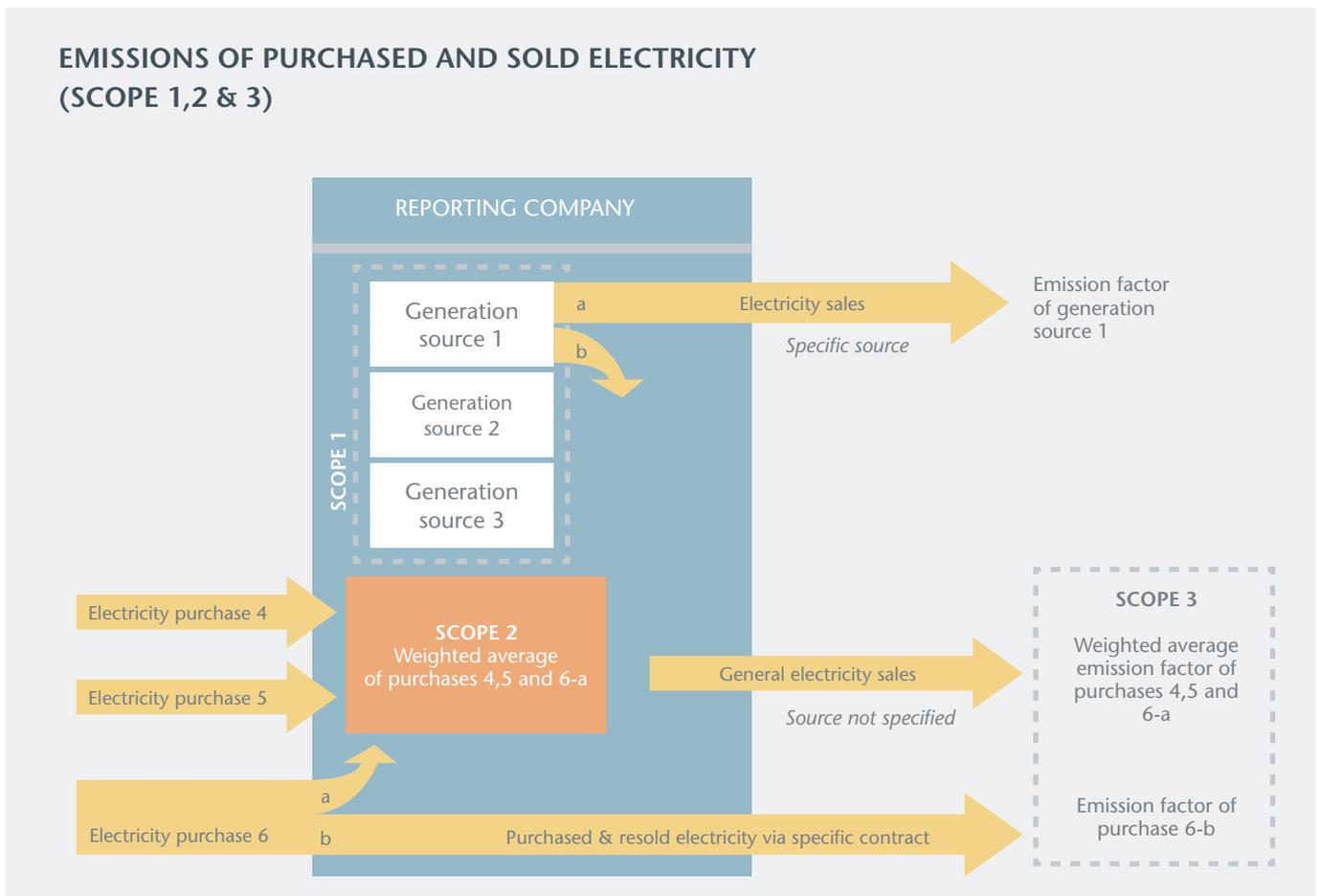
in scope 1 or scope 2. They may be reported under scope 3, category 3.

The case examples below (Case Examples A and B) illustrate a company with three different generation sources (1, 2 and 3) and three purchase sources (4, 5 and 6) for electricity. Each source of electricity generation or purchase has a different emission factor (t CO₂ per MWh). The yellow arrows represent electricity purchases or sales.

3. The guidance is developed under the assumption that the user of the guidance is not producing electricity with the primary objective of reselling this electricity, as the reporting company is a chemical company.

4. As long energy purchases > energy sales over the year.

Case example A: Accounting for different energy streams



Case example B: Calculation of weighted emissions factors

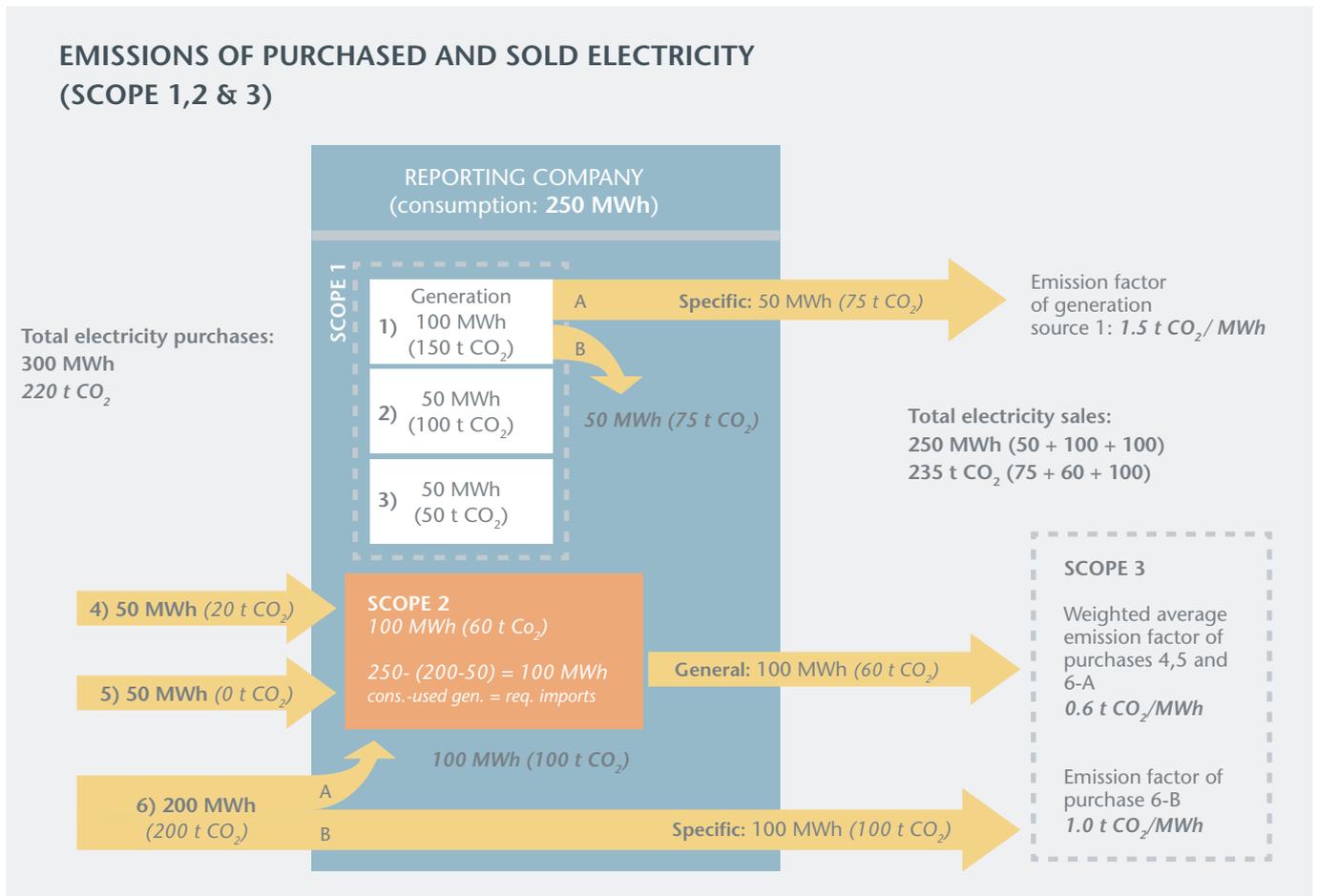


Illustration of netting of energy purchases with sales of energy for calculation of scope 2 emissions

		Q1	Q2	Q3	Q4	Yearly reported totals	
G	Generation (scope 1)	200	300	400	200	1100	Q1+Q2+Q3+Q4
P	Purchases	200	100	0	200	500	Q1+Q2+Q3+Q4
C	Consumption	350	350	350	350	1400	Q1+Q2+Q3+Q4
S	Sales	50	50	50	50	200	Q1+Q2+Q3+Q4
	Scope 2	150	50	-50	150	300	Purchases – Sales

2.4

Identifying the Scope 3 activities relevant for chemical companies to account for and report

Scope 3 includes emissions from all upstream and downstream activities of a company. Identifying emissions, assessing the opportunity to influence reductions, meeting stakeholder information needs and managing emissions should be balanced when measuring, reporting and managing scope 3 emissions. First, companies need to decide on what scope 3 categories of emissions to report. For example, companies producing intermediate products may be unable to estimate downstream emissions with a reasonable degree of accuracy and therefore chose to not publically report this emissions information. Additionally, not all categories may be relevant for all companies; although some of these categories may be judged to be relevant by

stakeholders such as municipalities, non-governmental organizations or society at large.

This section indicates the upstream and downstream scope 3 categories to be included in the GHG inventory for a chemical company.

GUIDANCE:

Companies shall measure and report emissions from the scope 3 categories identified below:

- o All Upstream scope 3 category as defined by the GHG Protocol Scope 3 Standard
- o Downstream scope 3 categories 9 (Downstream transportation and distribution); category 11 (Use of sold products – only

direct use-phase emissions); category 12 (End-of-life treatment of sold products); and category 15 (Investments – only material equity investments).

Other Scope 3 categories were found to be not applicable, or not relevant for the chemical industry (category 13: Downstream leased assets; category 14: Franchises), or cannot generally be estimated at this time due to the wide array of applications (category 10: Processing of sold products). Categories found to not be applicable or relevant should be periodically assessed for relevance at least once every three years.

Expected size of emissions (relative to company total)

Figure 3 Relevant categories of scope 3 emissions for chemical companies

	Business travel		7. Employee commuting	13. Downstream leased assets 14. Franchises 15. (Financial, debt, bonds, pension funds & other) Investments
Small				
	2. Capital goods 3. Fuel- and energy-related activities 4. Upstream and purchased transportation & distribution	8. Upstream leased assets 15. (Material equity) investments	5. Waste generated in operations 9. Downstream transportation & distribution	10. Processing of sold products
Medium				
	1. Purchased goods & services	12. End-of-life treatment of sold products	11. Direct emissions from use of sold products	11. Indirect emissions from use of sold products
Large				
	Large			Small
	Influence on emissions in the category			

RATIONALE FOR GUIDANCE

Chemical companies are generally aware of the value chain activities- and therefore the scope 3 categories- that are most relevant to their company. Participating companies found that the most relevant categories were generally the same from company-to-company. Therefore, developing guidance for which scope 3 categories to include in the inventory is a pragmatic approach for the sector. In addition, the reporting on some components of categories may not make sense to the chemical industry, particularly as chemical companies mainly produce intermediate products for which the end use often is not known. Companies indicated a wish for the guidance to prescribe as complete as possible measurement and reporting, so as to ensure reporting can meet stakeholder requirements and to prevent misunderstanding of reported information.

ADDITIONAL GUIDANCE FOR APPLYING THE SELECTED APPROACH

In selecting relevant scope 3 categories to measure and report on, the following principles were used to guide decision making. These borrow from the principles outlined in the GHG Protocol standards.

For those categories where reporting is not mandatory, companies should use a quick scan to estimate and

then select reporting categories. This method assists in assessing size of emissions using high-level estimates based on standard emission factors.

SIZE

Emissions in the scope 3 category contribute significantly to the reporting company's total anticipated scope 3 emissions

INFLUENCE

There are potential emissions reductions that could be undertaken or influenced by the reporting company

RISK

Emissions in the category contribute to the reporting company's risk exposure (e.g., climate change related risks such as financial, regulatory, supply chain, product and customer, litigation, and reputational risks)

STAKEHOLDERS

Emissions in the category are deemed critical by key stakeholders (e.g., customers, suppliers, investors, or civil society)

OUTSOURCING

Emissions in the category are outsourced activities previously performed in-house, or activities outsourced by the reporting company that are typically performed in-house by other companies in the chemical sector

SECTOR GUIDANCE

Emissions in the category have been identified as relevant by sector-specific guidance

ADDITIONAL CRITERIA

Emissions in the category meet any additional criteria for determining relevance developed by the company or industry sector

Case Example: Overview of the Scope 3 emissions of the BASF Group for 2011 (according to GHG Protocol)

Scope 3 Category	GHG Emissions (CO ₂ equivalents in millions of tons)
1 Purchased goods and services	62
2 Capital goods	2
3 Fuel and energy-related activities	3
4 Upstream transportation and distribution	3
5 Waste generated in operations	0.6
6 Business travel	0.3
7 Employee commuting	0.2
8 Upstream leased assets	0.3
9 Downstream transportation and distribution	0.1
10 Processing of Sold Products	Not determined*
11 Use of sold products	50
12 End-of-life treatment of sold products	30
13 Downstream leased assets	<0.1**
14 Franchises	Not relevant***
15 Investments	0.2****

Source: <http://www.basf.com/group/corporate/en/sustainability/environment/climate-protection/bilanzierung-treibhausgasemissionen>

Explanations:

* For a chemicals company at the beginning of the value chain, such as BASF, the effort to determine Scope 3 emissions from the further processing of our products (Category 11 Processing of Sold Products) is not reasonable.

** Expert estimate. The activities of BASF as a lessee account for less than 20% of our activities in the area of Leased Assets Upstream (Category 8).

*** BASF does not engage in franchising activities.

**** Data from 2009.

3 Collecting data and calculating GHG emissions

Collecting data for scope 1, 2 and 3 emissions information is a challenging step within the inventory process. The process will require the company to engage with and collect data from a number of suppliers in the value chain, and from across divisions of the company such as procurement, manufacturing and energy.

This section focuses on providing general guidance on collecting and calculating data; specific guidance for situations such as swap agreements and energy recovery; and guidance for data collection and calculation for relevant scope 3 activities. Companies shall follow the data collection and calculation requirements in the GHG Protocol standards and follow this additional guidance to promote consistent approaches for issues specific to the chemical sector.

The section is divided into two parts:

Part I: General guidance on data collection and calculation

Part II: Description and calculation guidance for scope 3 categories

Part I: General Guidance on Data Collection and Calculation

THE ISSUES ADDRESSED IN THIS SECTION INCLUDE:

1. Supplier data and secondary data
2. Final Products and Intermediate Products
3. Swapping Agreements and Trading

SUMMARY OF GENERAL GUIDANCE:

- Companies shall follow the guidance indicated for each relevant scope 3 category described in each section below.
- Emissions from each scope 3 category that are indicated as small in relation to overall scope 3 emissions (e.g. business travel and employee commuting) may be estimated using a standardized high level calculation. However:
 - o If more representative figures than the default factors provided are readily available, these figures shall be applied to calculate emissions;
 - o If the default calculation method confirms that emissions in a category are not material, the reporting company

may report zero emissions in the category, using the default calculation as rationale for this decision;

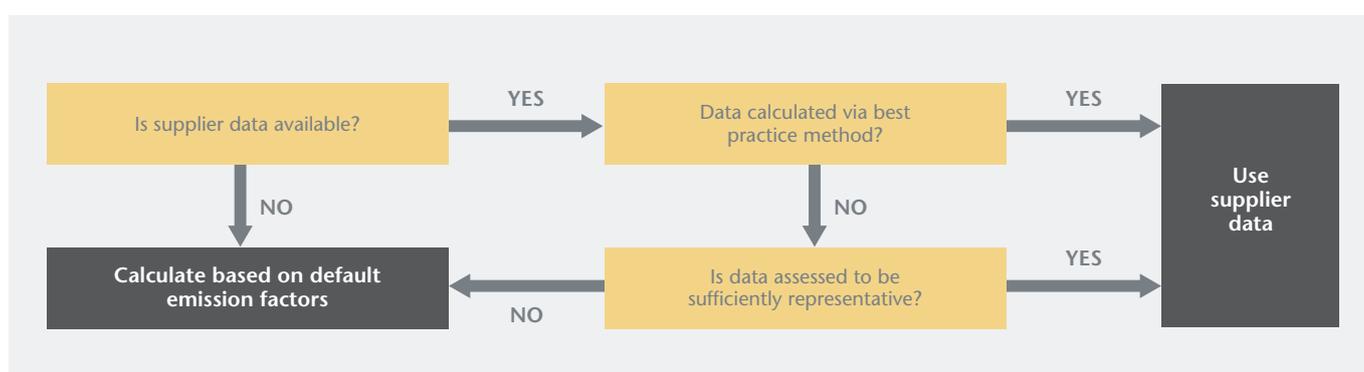
- o In cases where companies diverge from this guidance, the reporting company shall explain why it has chosen to diverge from this approach.
- Default figures are provided as a starting point; however companies should use the most representative data available⁵.
- Reporting on scope 3 downstream categories shall be done according to the GHG Protocol requirements for intermediate products (with the exception of category 10).
- In case of swapping agreements, the selling company shall report its own scope 1 & 2 emissions, and report transportation movements from the swapping partner to the customer (in scope 3).
- The GHG Protocol scope 3 calculation guidance found at www.ghgprotocol.org may be helpful when specific methodologies are not prescribed.

5. Please see the data quality indicators referred to in the GHG Protocol Scope 3 Standard (pages 76-77) for additional.

3.1 Supplier data and secondary data

Inconsistencies in emissions information may arise when one company uses supplier data while another company uses secondary data, for the same activity. Due to wide variances in the quality and method of calculation of data from suppliers, no one source of data for scope 3 categories is preferred in this guidance document. However, the decision tree below (Figure 4) is useful to guide companies in their data collection and calculation efforts, and should be used with the guidance for each relevant scope 3 category described in this section.

Figure 4 Data Source Decision Tree



3.2 Final Products and Intermediate Products

Chemical companies typically sell intermediate products. Intermediate products are those that a company produces for another company to purchase and then further process, transform or include in another product⁶. This document does not provide guidance on final products, but includes specific guidance for chemical companies to measure and report emissions from intermediate products related to, Downstream Transportation (Category 9), Use of Sold Products (Category 11), and End of Life Treatment of Sold Products (Category 12). This guidance is found in Part II of this chapter below.

3.3 Swapping Agreements and Trading

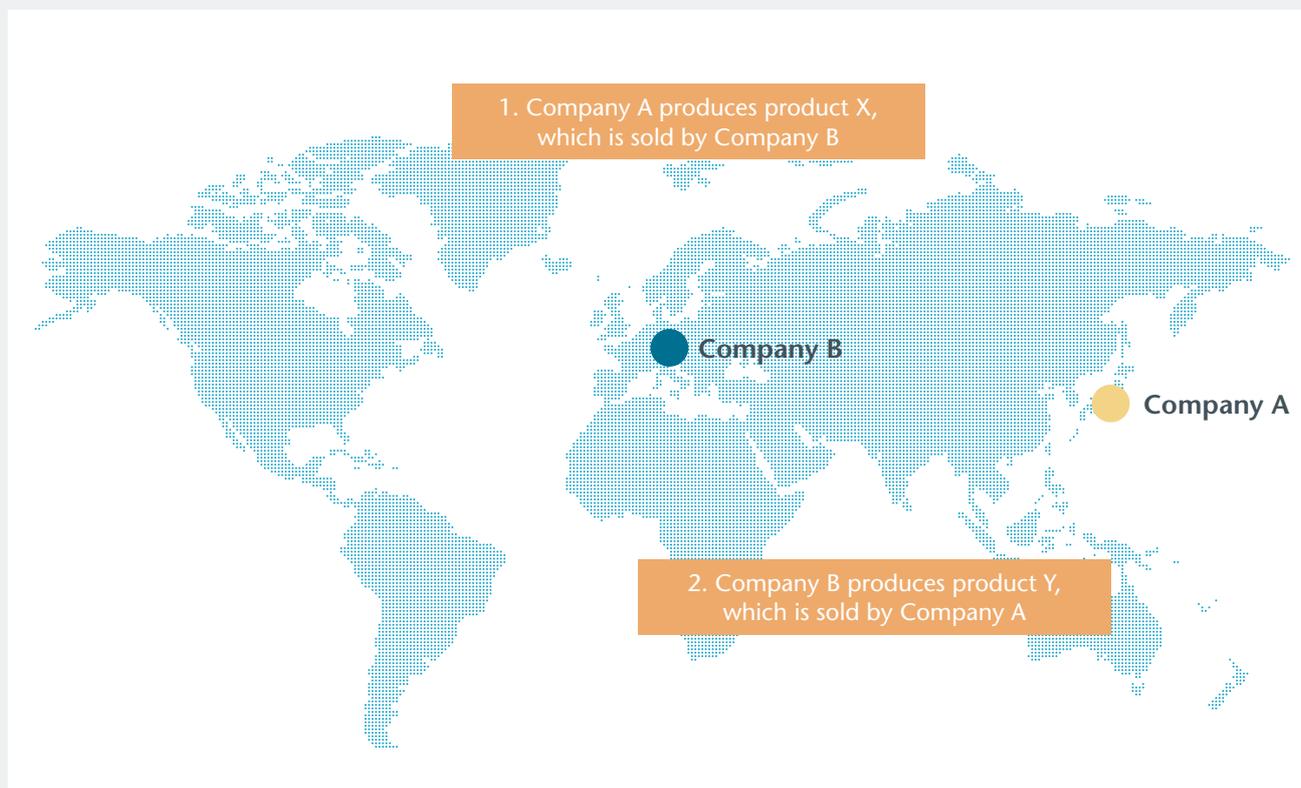
CALCULATION GUIDANCE:

- In case of swapping agreements, the selling company shall report its own scope 1 and 2 emissions, and report transportation movements from the swapping partner to the customer (in scope 3).
- In case of trading, the trading company shall report the related emissions under scope 3, notably categories 1 (Purchased goods and services), 4 and 9 (Upstream and downstream transportation and distribution), 11 (Use of sold products – if applicable) and category 12 (end-of-life treatment of sold products).

6. Definition is adapted from the GHG Protocol Scope 3 Standard, page 39.

Case example: Emissions related to swapping agreements

DESCRIPTION OF THE SWAPPING AGREEMENT



COMPANY A

Scope 1 & 2: Emissions related to the production of product X

Scope 3 upstream: Scope 3 upstream emissions related to product X

Scope 3 downstream: Transportation movements of product Y from the swapping partner's premises to the tier-1 customer



COMPANY B

Scope 1 & 2: Emissions related to the production of product Y

Scope 3 upstream: Scope 3 upstream emissions related to product Y

Scope 3 downstream: Transportation movements of product X from the swapping partner's premises to the tier-1 customer

Part II: Description and calculation guidance for scope 3 categories

DESCRIPTION AND CALCULATION GUIDANCE FOR SCOPE 3 CATEGORIES

This section provides a description and standardized calculation guidance for the scope 3 categories relevant for chemical companies.

Category 1: Purchased goods & services

DESCRIPTION OF CATEGORY

- The category includes emissions generated during extraction, production, and transportation (cradle to tier-1 supplier gate emissions) of goods/services purchased or acquired by the reporting company in the reporting year (unless included in another category).
- The category includes both products and services.
- Examples of purchased goods and services of a chemical company are: machining and processing services; engineering services; raw materials

such as ethylene, sodium carbonate, methanol; and industrial cleaning.

CALCULATION GUIDANCE

- The total emissions in this category shall be calculated using a breakdown of most relevant product and/or service group and their respective emission factors⁷.
- Companies should calculate emissions from at least 80% (by volume or weight) of purchased goods and services, after which results should be extrapolated to estimate 100% of emissions.

DATA GATHERING GUIDANCE

- If tier 1 suppliers can provide product-level cradle-to-gate GHG data, this data shall be used to report on category 1 (see also Chapter 3.2, Figure 3.1)
- In cases in which product-level cradle-to-gate data is not available from the supplier, the reporting company may either use:

- Secondary data on product-level emissions
- Tier-1 supplier's company level emissions as the basis for calculating product-level emissions (e.g. by relating spend volume to revenue of the supplier)

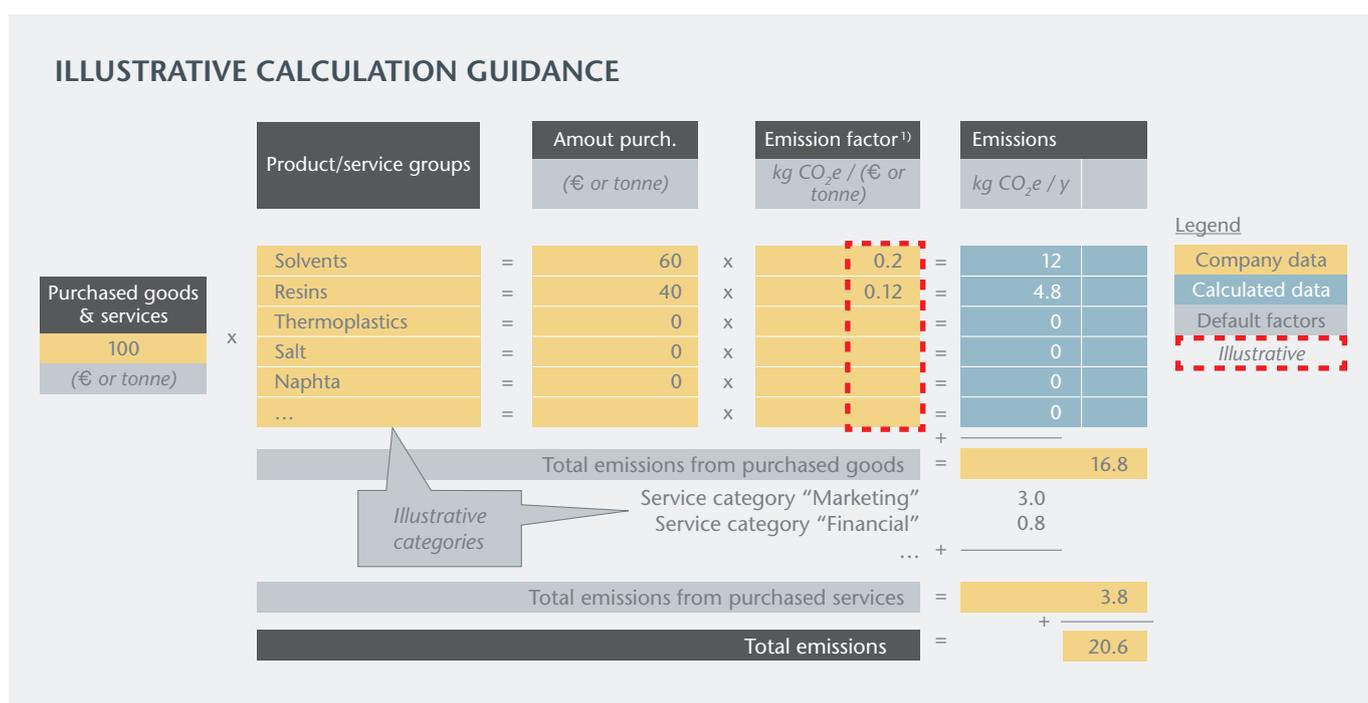
EXAMPLES OF PRIMARY DATA USED

- Product-level cradle-to-gate GHG data from suppliers calculated using site-specific data
- Site-specific energy use or emissions data from suppliers broken down to the product level

EXAMPLES OF SECONDARY DATA USED

- Industry average emission factors per material consumed from life cycle inventory databases

7. The used emission factors should be based on analysis of 80% of total spend or purchase volume by weight of a product/service group



Category 2: Capital goods

DESCRIPTION OF CATEGORY

- The category includes emissions generated during extraction, production, and transportation (i.e. cradle to tier 1 supplier gate emissions) of capital goods purchased or acquired by the reporting company in the reporting year.
- Capital goods are final goods that are not immediately consumed or further processed by the company, but are instead used in their current form by the company to manufacture a product, provide a service, or sell, store and deliver merchandise. They are written off over time.
- Emissions related to the disposal of capital goods shall be reported in category 5, Waste generated in operations.

- Examples of capital goods for a chemical company include: forklifts, heat exchanger, naphtha cracker, etc.

CALCULATION GUIDANCE

- Emissions from Capital Goods shall be reported in the year(s) the capital good was purchased and shall not be written off over the number of years the good is used.
- The total emissions in this category can be calculated based on a default split in capital good spending for different materials, or company specific figures if available.
- If data on the composition of capital goods or their emission factors is not available, companies shall assume the capital good is made out of 25% concrete and 75% steel.
- If the construction of the capital good takes place over multiple

reporting years, emissions shall be reported proportionally to expenditure on the capital good in the year of reporting.

EXAMPLES OF PRIMARY DATA USED

- Product-level cradle-to-gate GHG data from suppliers calculated using site-specific data
- Site-specific energy use or emissions data from capital goods suppliers broken down to the purchased good

EXAMPLES OF SECONDARY DATA USED

- Industry average emission factors per material consumed from life cycle inventory databases

ILLUSTRATIVE CALCULATION GUIDANCE

	Composition of capital goods		Amount purch. (€ or ton)		Emission factor kg CO ₂ e / (€ spend)		Emissions kg CO ₂ e / y	
Purchased capital goods 100 € spend	Concrete	25%	25	x	1.3	=	33	Legend Company data Calculated data Default factors
	Steel	75%	75	x	2.85	=	214	
	Iron	0%	0	x	2.85	=	0	
	Aluminium	0%	0	x	2.1	=	0	
		0%		x		=	0	
		0%		x		=	0	
Total emissions							+	247

Default factors taken from sources listed in appendix A

Category 3: Fuel and energy related activities (not included in scope 1&2)

DESCRIPTION OF CATEGORY

- The category includes emissions generated during extraction, production, and transportation (i.e. cradle to reporting company gate emissions) of fuels and energy purchased or acquired by the reporting company in the reporting year.
- Any emissions related to losses in the energy transport & distribution network (T&D losses) are accounted for in this category by the end user.
- Any emissions related to purchased electricity sold to an end-user shall be reported in this category.
- Please see section 2.2 for a description and specific guidance related to setting operational

boundaries for Fuel and Energy Related Activities.

CALCULATION GUIDANCE

- Activities related to electricity purchased; other energy purchased; and energy purchased and resold, should be separated to aid calculation.

EXAMPLES OF PRIMARY DATA USED

- Company-specific data on upstream emissions (e.g. extraction of fuels)
- Grid-specific T&D loss rate
- Company-specific power purchase data and generator-specific emission factor for purchased power

EXAMPLES OF SECONDARY DATA USED

- Regional average data on upstream emissions (e.g. from life cycle inventory database)
- Regional average T&D loss rate
- Regional average power purchase data (i.e., Scope 2)

ILLUSTRATIVE CALCULATION GUIDANCE

	Region	T&D Loss rate	Emission factor of purchased energy (of the scope 1 supplier)	Emissions
		%	kg CO ₂ e / GWh	kg CO ₂ e / y
Emissions from T&D losses (based on purchased electricity)	Europe	100%	7%	280
	Asia and Middle East	0%	7%	0
	North America	0%	7%	0
	South America	0%	7%	0
	Africa	0%	7%	0
	Upstream emission factors			
	kg CO ₂ e / (GWh, m ³ or t)			
Upstream emissions related to purchased energy	Electricity	100	3	300
	Fuel	100	3	300
	Emission factors (electricity)			
	kg CO ₂ e / GWh			
Emissions related to purchased & resold energy	Energy	100	3	300
	Total emissions			1,180

Legend

- Company data
- Calculated data
- Default factors
- Illustrative

Default factors taken from sources listed in appendix A

Category 4: Upstream transportation & distribution

DESCRIPTION OF CATEGORY

- The category includes emissions generated during transportation and distribution of purchased products and services between a company's tier 1 suppliers and its own operations (in vehicles and facilities not owned or controlled by the reporting company).
- This category does not include the emissions from the transportation of sold products for which transportation and distribution services have been purchased by the reporting company. These emissions are included in Category 9, Downstream Transportation and Distribution⁸.
- If financial data is used to model transportation between suppliers and the reporting company, care should be taken to:
 - Include transportation movements for which the reporting company has not directly paid for;

- Exclude any transportation movements with vehicles owned by the reporting company from which the emissions have already been recorded as scope 1 emissions.

- Companies may also follow the method specified in the GHG Protocol Scope 3 Standard if more practical, but must ensure that all transportation movements between tier 1 supplier, reporting company and tier 1 customer are accounted for.

CALCULATION GUIDANCE

- The total emissions per transportation mode shall be calculated based on the total transported volume⁹, mode breakdown, average transport distance, average transport distance, and default emissions factors.
- For Intermodal, average transport distance should resemble overall average transport distance of modes connected. Default emission factors are based on CEFIC-Ecta *Guidelines for Measuring and Managing CO₂ emissions from Freight transport operations*.

For example for road transport, the CEFIC-Ecta default factor is based on an average load factor of 80% of the maximum vehicle payload and 25% of empty running.

EXAMPLES OF PRIMARY DATA USED

- Activity-specific energy use or emissions data from third-party transportation and distribution suppliers
- Actual distance traveled
- Carrier-specific emission factors

EXAMPLES OF SECONDARY DATA USED

- Estimated distance traveled by mode based on industry-average data

8. The inclusion of emissions for the purchased transportation and distribution of sold products in Category 8, Downstream Transportation and Distribution is in contradiction to the GHG Protocol Scope 3 Standard. However, companies involved in the development of this guidance felt this was aligned with financial practices and will still result in the full inclusion of the emissions associated with transportation and distribution services purchased by the reporting company.

9. Total volume purchased corrected for transport using own trucks (reported in scope 1).

ILLUSTRATIVE CALCULATION GUIDANCE

Subcategory	Average transport distance <i>km</i>	Transport emissions <i>g CO₂e / t-km</i>	Emissions <i>kg CO₂e / y</i>
Road 37%	500	62	1,147
Rail 12%	500	22	132
Ship 26%	500	31	403
Pipeline 2%	10	5	0.1
Air 0%	7,000	602	0
Intermodal 23%	1,000	27	621
Total emissions			2,303.1

Volume transported: 100 tonne

Legend: Company data (yellow), Calculated data (blue), Default factors (grey), Illustrative (red dashed border)

Default factors taken from sources listed in appendix A

Category 5: Waste generated in operations

DESCRIPTION OF CATEGORY

- The category includes emissions generated during disposal and treatment of waste generated in the reporting company's operations in the reporting year (from facilities not owned or controlled by the reporting company).
- The category also includes emissions related to the disposal of capital goods.
- If waste generated in operations is used for energy recovery applications, it should not be regarded as "waste" for the purposes of the GHG inventory¹⁰.

- The emissions associated with the disposal of this waste are reported as scope 1 emissions by the company that is using the waste as fuel to generate energy.

CALCULATION GUIDANCE

- Emissions resulting from waste generated in operations can be estimated based on the waste treatment breakdown of the company and default emission factors.
- The emissions for recycled products shall be reported as zero.
- Examples of primary data used

- Site-specific emissions data from waste management companies
- Company-specific metric tonnes of waste generated
- Waste company-specific emission factors

EXAMPLES OF SECONDARY DATA USED

- Estimated metric tonnes of waste generated based on industry-average data
- Industry average emission factors

ILLUSTRATIVE CALCULATION GUIDANCE									
	Waste treatment		Subtotal		Carbon content		Emission factor		Emissions
			tonne		t C / t product		t CO ₂ eq / t C		t CO ₂ eq / y
Waste volume from operations 100	Incinerated	20%	= 20	x	80%	x	1	=	16
	Landfilled	80%	= 80	x	80%	x	13	=	832
	Recycled	0%	= 0	x	NA	x	0	=	0
	+								
Total emissions									848

Legend

- Company data
- Calculated data
- Default factors
- Illustrative

Default factors taken from sources listed in appendix A

10. Waste is defined as a product which has no further processing or use and will directly proceed to end of life phase.

Category 6: Business travel

DESCRIPTION OF CATEGORY

- The category includes emissions generated during transportation of employees for business-related activities in the reporting year (in vehicles not owned or operated by the reporting company), unless these emissions are already reported in a different category.

CALCULATION GUIDANCE

- Based on the mode breakdown for business travel and average distance per mode per year, companies are able to calculate total emissions in this category, using either provided default factors or their own specific emission factors.

EXAMPLES OF PRIMARY DATA USED

- Activity-specific data from transportation suppliers (e.g., airlines)
- Carrier-specific emission factors

EXAMPLES OF SECONDARY DATA USED

- Estimated distance traveled based on industry-average data

ILLUSTRATIVE CALCULATION GUIDANCE						
Mode		Total distance /mode/year <i>km</i>		Emission factor <i>g CO₂e / km</i>		Emissions <i>kg CO₂e / y</i>
Car	x	1,000	x	230	=	230
Rail	x	1,000	x	120	=	120
Air	x	1,000	x	170	=	170
Other	x		x		=	0
Total emissions					=	520

Legend

- Company data
- Calculated data
- Default factors
- Illustrative

Default factors taken from sources listed in appendix A

Category 7: Employee commuting

DESCRIPTION OF CATEGORY

- The category includes emissions generated during transportation of employees between their homes and their worksites in the reporting year, unless these emissions are already reported in a different category (e.g. scope 1 if the reporting company owns company cars; or scope 3 (category 8) Upstream Leased Assets if the reporting company leases cars for its employees).

CALCULATION GUIDANCE

- Companies shall calculate and report on the emissions from employee commuting, but may choose the most practical scope 3 category to include these emissions in (e.g. companies may include employee commuting emissions from leased cars in scope 1 or scope 3, category 7).

- Companies should report on the percentages per transport mode used in the calculation (e.g. car, rail, bus/tram).
- Where carpooling policies are in place with significant contribution, the percent using a car can be corrected, or a 'carpooling' category can be created.
- When more specific data is not known:
 - Use default mode of 100% travel by car (1 employee per car)
 - Use default average number of trips as 440 (220 days * 2 = 440)
 - Use default travel distance of 30km by car or rail, and 20 km by bus or tram
 - Use average CO₂ emission factors from DEFRA (cars) , and

the U.S. EPA (train/bus) (please see Appendix A for more detail)

EXAMPLES OF PRIMARY DATA USED

- Specific distance traveled and mode of transport collected from employees

EXAMPLES OF SECONDARY DATA USED

- Estimated distance traveled based on industry-average data

ILLUSTRATIVE CALCULATION GUIDANCE

		Mode		Avg distance/ single trip <i>km / trip</i>		Trips / year <i>#/employee/year</i>		Emission factor <i>g CO₂e / km</i>		Emissions <i>kg CO₂e / y</i>	
# employees 110,000	x	Car	100%	x	30	x	440	x	230	=	3,036
		Rail	0%	x	30	x	440	x	120	=	0
		Bus/tram	0%	x	20	x	440	x	70	=	0
		...	0%	x	...	x	...	x	...	=	0
			0%	x		x		x		=	0
			0%	x		x		x		=	0
										+	
										=	3,036

Legend

- Company data (Yellow background)
- Calculated data (Blue background)
- Default factors (Grey background)
- Illustrative (Red dashed border)

Default factors taken from sources listed in appendix A

Category 8: Upstream leased assets

DESCRIPTION OF CATEGORY

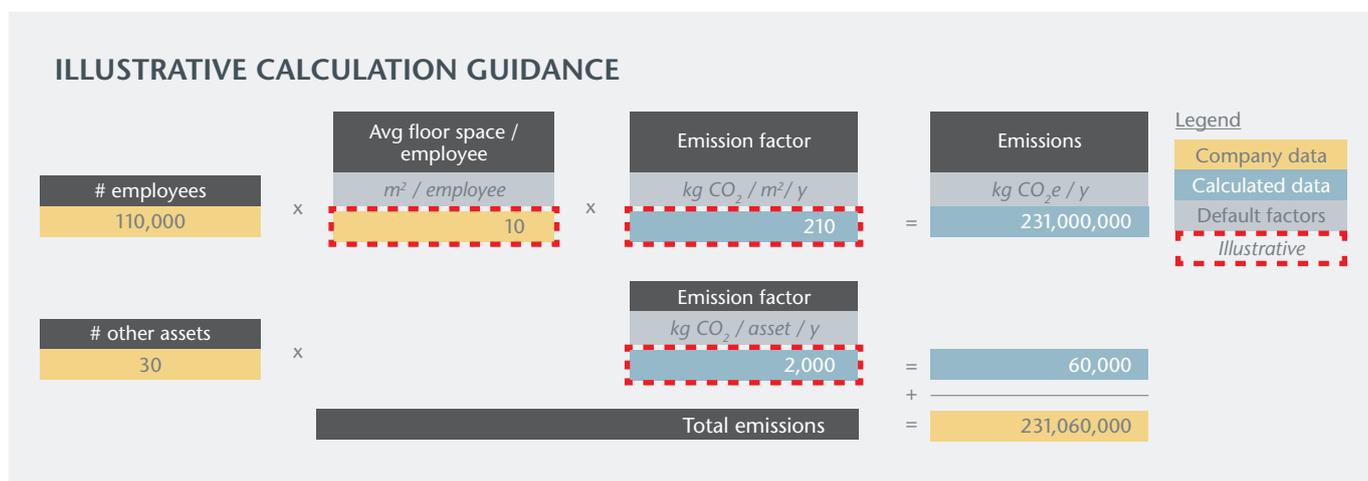
- The category includes emissions generated during the operation of assets leased by the reporting company (lessee) in the reporting year and not included in scope 1 and scope 2
- In the case of a swap agreement, the reporting company shall report the scope 1 and 2 emissions of its own operations, related to the manufacturing of the product in question
 - o The scope 1 and 2 emissions from the swapping partner shall not be reported in the scope 1, 2 or 3 inventory
 - o Chemical companies may separately report the emissions of the partner company in case of swap arrangements
- o The reporting company shall record transportation movements from the swapping partner to the tier-1 customer in category 8
- o Any volumes delivered through the swapping partner in excess of the swapping agreement shall be reported as category 1 Purchased Goods & Services using the GHG emission factor of the producing party
- Upstream leased assets shall only be reported in scope 3 in case of operational lease. In case of financial lease, the asset or its respective emissions are included in scope 1 and 2.
- Companies may report emissions from leased vehicles not included in scope 1 in this category or in employee commuting, as long as the emissions are accounted for and reported.

EXAMPLES OF PRIMARY DATA USED

- Site-specific energy use data collected by utility bills or meters

EXAMPLES OF SECONDARY DATA USED

- Estimated emissions based on industry-average data (e.g. energy use per floor space by building type)



Default factors taken from sources listed in appendix A

Category 9: Downstream transportation and distribution

DESCRIPTION OF CATEGORY

- For chemical companies producing primarily intermediate products, the category only includes emissions generated during transportation and distribution of products sold by the reporting company in the reporting year between the point of sale of the reporting company and their direct business customers.
- If financial data is used to model transportation between the reporting company and customers, care should be taken to:
 - Include transportation movements for which the reporting company has not paid;
 - Ensure that transportation movements between the reporting company and the customer are not included twice (upstream and downstream), if the transportation is paid for by the reporting company.

- Companies may also follow the method specified in the GHG Protocol Scope 3 Standard if more practical, but must ensure that all transportation movements between tier 1 supplier, reporting company and tier 1 customer are accounted for and reported.

CALCULATION GUIDANCE

- The total emissions per transportation mode shall be calculated based on the total transported volume, mode breakdown, average transport distance, and default emissions factors.
- Total transported volume is equal to total volume sold corrected for transport using own trucks which is reported in scope 1.
- For Intermodal, average transport distance should resemble overall average transport distance of modes connected.
- When more specific data is not known, companies should use default emission factors from *CEFIC-Ecta Guidelines for Measuring and Managing CO₂ emissions from Freight Transport Operations* (noted in Appendix A).

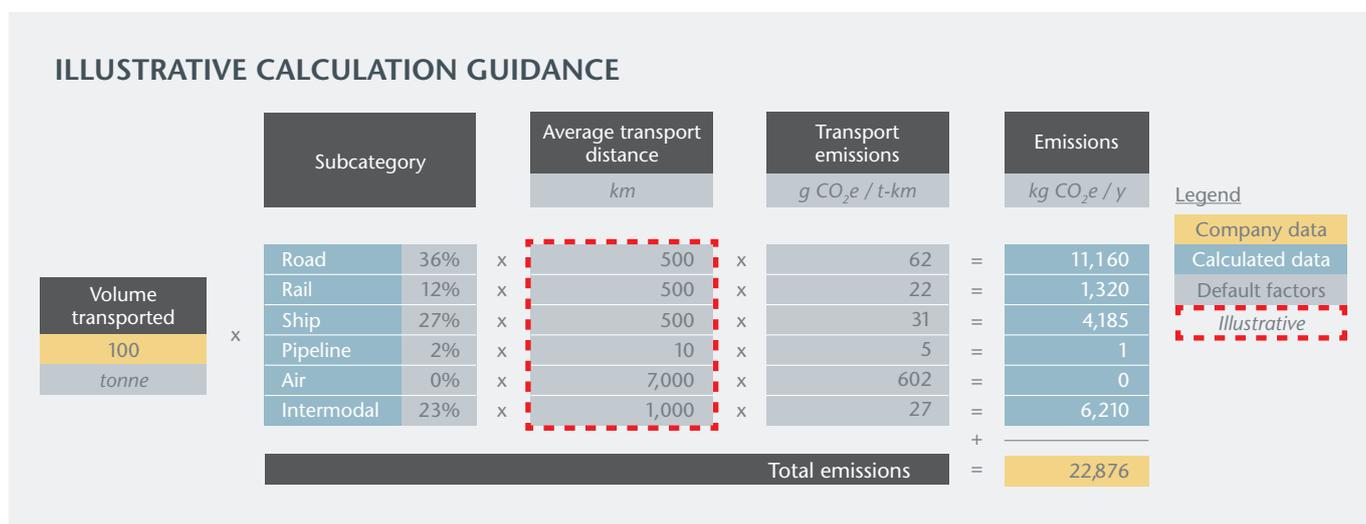
For example for road transport, the provided default factor is based on an average load factor of 80% of the maximum vehicle payload and 25% of empty running.

EXAMPLES OF PRIMARY DATA USED

- Activity-specific energy use or emissions data from third-party transportation and distribution partners
- Activity-specific distance traveled
- Company-specific emission factors (e.g., per metric tonne-km)

EXAMPLES OF SECONDARY DATA USED

- Estimated distance traveled based on industry-average data
- National/regional average emission factors



Default factors taken from sources listed in appendix A

Category 10: Processing of sold products

DESCRIPTION OF CATEGORY

- The category includes emissions generated during processing of intermediate products sold in the reporting year by downstream companies (e.g. injection molders).
- Any direct processing emissions from, for example, the leaking of GHG emissions during processing (e.g. HFC leakage during the production of the refrigerator) are reported in this category.

CALCULATION GUIDANCE

- Chemical companies are not required to report scope 3, category 10 emissions, since reliable figures are difficult to obtain due to the diverse application and customer structure.
- If companies choose to report category 10 emissions, please refer to guidance for scope 3 category 11 (Use of Sold Products) for information on calculating use-phase emissions.

Category 11: Use of sold products

DESCRIPTION OF CATEGORY

- The category includes emissions that are directly emitted during the use-phase of goods and services sold by the reporting company in the reporting year.
- Direct use-phase emissions from sold products and services from the chemical sector typically include:
 - o Combusted fuels: for example, oil, natural gas, and biofuels
 - o Products that contain or form greenhouse gases (CO₂, CH₄, N₂O, HFCs, PFCs, SF₆) that are emitted during use: for example, leakage/emissions of refrigeration and air-conditioning equipment, industrial gases, fire extinguishers, fertilizers.

CALCULATION GUIDANCE

- Chemical companies shall report direct use-phase emissions from sold products that directly emit GHG emissions following the GHG Protocol Scope 3 Standard.
- Chemical companies should not include indirect use-phase emissions in the inventory, unless the end use of chemical products is known.
- Companies may calculate emissions from category 11 without collecting data from customers or consumers.

EXAMPLES OF PRIMARY DATA USED

- Specific data collected from consumers

EXAMPLES OF SECONDARY DATA USED

- Estimated energy used based on national average statistics on product use
- Average N₂O field emissions as a function of fertilizer type from scientific literature

CASE EXAMPLES:

- 100 metric tonnes of natural gas is sold:
 - o 20% used as raw material and 80% used as fuel → 80% of emissions resulting from burning gas is reported under category 11;
- 50 tonnes of products sold that contain HFC:
 - o Leakage rate over the use phase is 30% → 30% of HFC contained in products sold (15 tonnes) is reported under category 11.

Category 12: End-of-life treatment of sold products

DESCRIPTION OF CATEGORY

- The category includes emissions generated during waste disposal and treatment of products sold by the reporting company (in the reporting year) at the end of their life.

CALCULATION GUIDANCE

- Companies shall report end-of-life emissions using current average recycle rates and waste management emissions, and report the assumptions:
- Waste management emissions shall be estimated by evaluating emissions from processing of waste
- Emissions occurring during product disposal by landfill shall be estimated the following ways:
 - o For sold products which are GHG emissions or contain GHG emissions, use the global warming potential (GWP) of the sold products;
 - o For sold products which are known to degrade within a period of 100 years, use the carbon content method¹¹ unless more representative figures are available;
 - o For sold products which are known to not degrade within a period of 100 years (for example, durable polymers), no emissions are generated within the time frame and therefore zero emissions are reported^{12,13}.

- o Emissions occurring during product disposal by incineration shall be either calculated based on primary data collected from waste management providers or estimated using the carbon content method

- Region-specific default factors for % landfill, % recycling and % incineration and GHG emissions factors (CO₂, CH₄ and other GHGs) shall be used for each of these end-of-life pathways, using figures from a competent authority (e.g. a government agency).
- Energy recovery processes shall be included in the end-of-life phase; recycling processes shall be included in upstream scope 3 emissions (purchased goods and services) of the company purchasing the recycled product.
- Companies shall only account for emissions from the first lifecycle of the product, not for any emissions following the recycling of the product.
- The mass of finished goods may be adjusted in case direct emissions from product use have been reported in category 11, to avoid double counting:
 - o The emission factor for recycled products and the allocated share of energy recovery will be reported as zero
- Companies shall report all GHG emissions from waste incineration.

In the case of substantial energy recovery, companies may allocate a portion of the emissions to generated energy. Please see specific guidance below.

- Unless more specific data is known, companies may use the following assumptions for default factors (data source see Appendix A):
 - o Assume default factors of 80% to landfill and 20% incinerated for the end-of-life treatment of products (please see appendix A for default sources);
 - o Assume default carbon content of chemical waste as 80% based on Petroleum products, solvents, plastics;
 - o Assume for landfill, that 50% of the contained carbon is converted into CO₂ (GWP=1) and 50% into methane (GWP=25), unless the sold product is a durable plastic, in which case the default factor is zero.

11. Method assessing CO₂ emissions via average content of carbon in product, carbon fraction oxidized and weight ratio CO₂/C

12. United States Environmental Protection Agency Waste Calculator for plastics, sec 4.5: <http://www.epa.gov/climatechange/waste/downloads/Plastics.pdf>

13. The reporting of zero emissions for the landfilling of durable plastics does not imply that no environmental burden is generated during this process.

ILLUSTRATIVE CALCULATION GUIDANCE

	End-of-life treatment		Subtotal		Carbon content		Emission factor		Emissions		
			tonne		t C / t product		t CO ₂ eq / t C		t CO ₂ eq / y		
Mass of finished goods 100 t	Incinerated	20%	20	x	80%	x	1	=	16		
	Landfilled	80%	80	x	80%	x	13	=	832		
	Recycled	0%	0	x	NA	x	0	=	0		
								+			
	Total emissions								=	848	

Legend

Company data
Calculated data
Default factors
<i>Illustrative</i>

Default factors taken from sources listed in appendix A

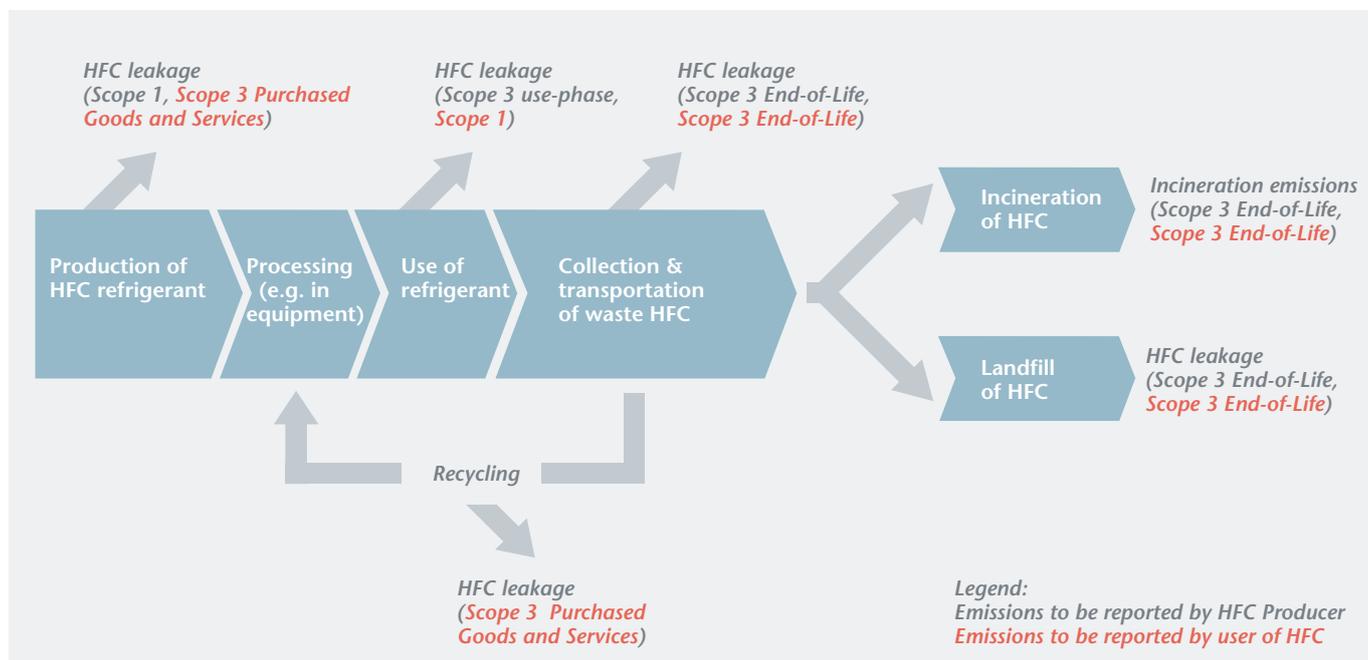
EXAMPLES OF PRIMARY DATA USED

- Specific data collected from consumers on disposal rates
- Specific data collected from waste management providers on emissions rates or energy use

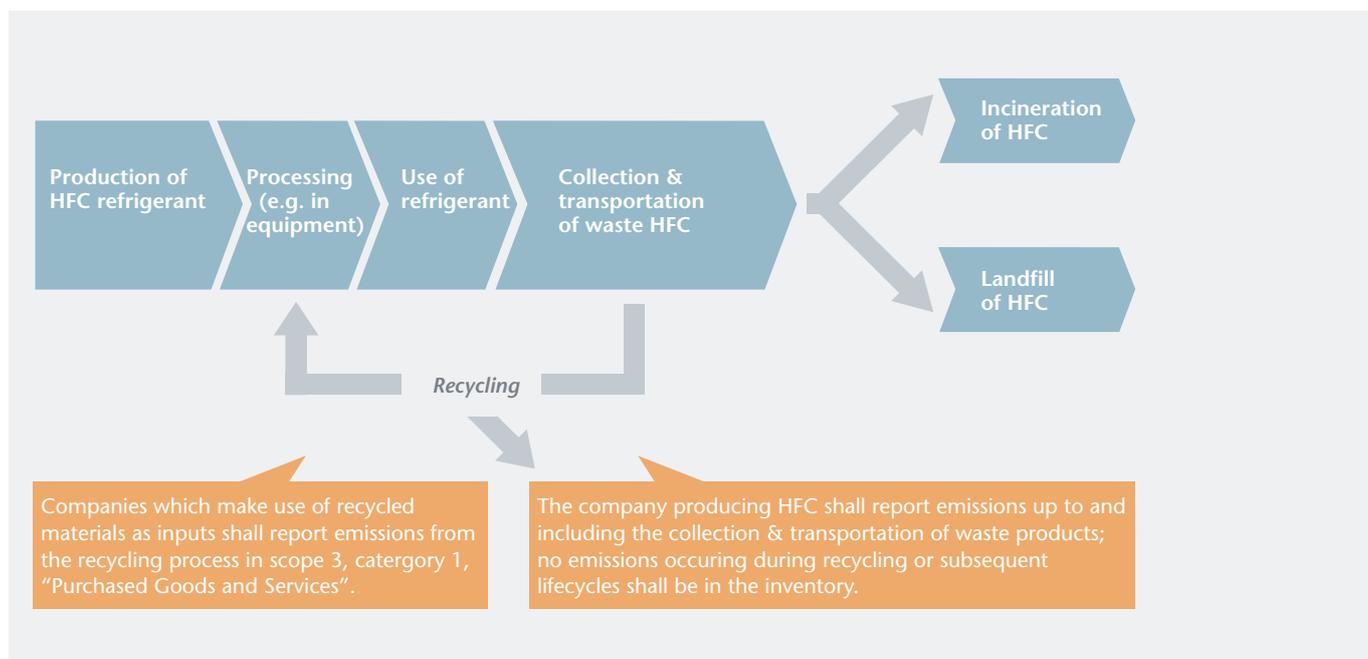
EXAMPLES OF SECONDARY DATA USED

- Estimated disposal rates based on national average statistics
- Estimated emissions or energy use based on national average statistics

Case Example: End-of-life product emissions
Emissions from leaked greenhouse gases are reported in the value chain step where the leak takes place



Case Example: Reporting emissions from recycling



EMISSIONS FROM ENERGY RECOVERY

Increasingly, waste from chemical companies is incinerated to take advantage of the energy contained in the product. Inconsistencies can occur in the calculation and reporting of GHG emissions when companies use different approaches for waste incineration with energy recovery. The guidance below is intended to provide a consistent approach for companies within the chemical sector.

Companies shall report all GHG emissions from waste incineration. In the case of substantial energy recovery, companies may allocate a portion of the emissions to generated energy.

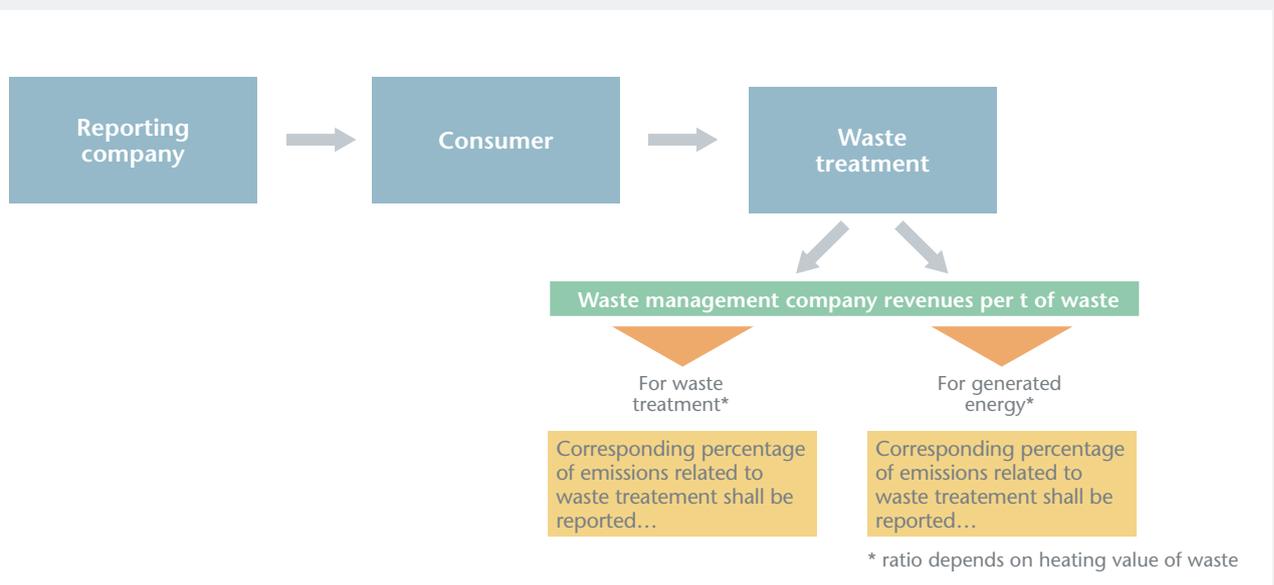
CALCULATION GUIDANCE

- If a substantial amount of energy is recovered through waste incineration, companies may:
 - o Allocate a portion of emissions from waste treatment companies to the energy generation, using an allocation method consistent with the allocation decision tree described in chapter 4 and with on-site energy generation from waste;
 - o Consider energy recovery through waste incineration to be similar to recycling so as to avoid any double-counting to occur within the same reporting boundary;
 - o Report emissions allocated to energy generation with a zero emissions factor (consistent with recycling guidance).
- In the default calculation method, waste incineration does not have energy recovery and related allocated zero emission factor.
- Companies shall not report any credits or avoided emissions from energy recovery through waste incineration to ensure consistency with the GHG protocol standards.

Case example:

Allocating emissions from the waste treatment process to treatment and energy generation/recovery

CASE EXAMPLE FOR EMISSIONS RELATED TO ENERGY RECOVERY



Category 15: Investments

DESCRIPTION OF CATEGORY

- The category includes emissions generated during operation of investments in the reporting year, not included in scope 1 or scope 2.

CALCULATION GUIDANCE

- Chemical companies shall report all scope 1 and 2 emissions of non-consolidated investments of which they hold a minimum interest of 20%.

- Scope 1 and 2 emissions from investments that are not consolidated in Scope 1 or 2 of the reporting company shall be reported according to the company's stake in this category.
- Chemical companies should not report on debt investments and other investments or financial services, as they are generally not relevant.

EXAMPLES OF PRIMARY DATA USED

- Site-specific energy use or emissions data

EXAMPLES OF SECONDARY DATA USED

- Estimated emissions based on industry-average data

Illustrative Guidance:

	Description of example situation		Implication for reporting on GHG emissions	
	Description of joint arrangement	Financial consolidation	Report in scope 1/2 (following consolidated affiliate revenues)	Report in scope 3 - Investments
1	Company owns 100% of shares of affiliate	100% of affiliate revenues	100%	0%
2	50/50 Joint Venture	100% of affiliate revenues	100%	0%
3	50/50 Joint Venture	0% of affiliate revenues	0%	50%
4	50/50 Joint Venture	50% of affiliate revenues	50%	0%
5	20% interest	0% of affiliate revenues	0%	20%
6	3% interest	0% of affiliate revenues	0%	0%

4 Allocating GHG emissions

Allocation is the partitioning of emissions from one system amongst its various outputs (e.g. partitioning the emissions from a steam cracker to its outputs such as ethylene and propylene). While allocation is not an issue specific only to the chemical industry, applying consistent approaches to allocation will support the more consistent accounting and reporting of emissions from the industry.

This section includes prescriptive instructions to support companies in the selection of the most appropriate allocation method for the most common process types.

The allocation guidance in this section is not applicable to allocation for product-level GHG inventories.

ISSUES ADDRESSED IN THIS SECTION INCLUDE:

1. Selection of allocation methods
2. Allocation of emissions from Combined Heat and Power (CHP) installations

SUMMARY OF GENERAL GUIDANCE IN THIS SECTION

- Companies shall avoid allocation if possible.
- If companies have to allocate, they should use physical allocation, unless:
 - o Economic value of different outputs differ substantially;

- o Outputs cannot be quantified using the same physical unit (e.g. a material and energy as output).
- The decision tree (Figure 5 below) provides guidance on the selection of the appropriate allocation method that should be followed.

4.1 Selecting an Allocation Method

In cases where multiple outputs are a result of a single process, GHG emissions need to be allocated. The GHG Protocol Scope 3 Standard describes multiple allocation methods but does not prescribe a single approach. Selection of different allocation methods by different chemical and/or value chain companies may result in inconsistent reporting of GHG inventories.

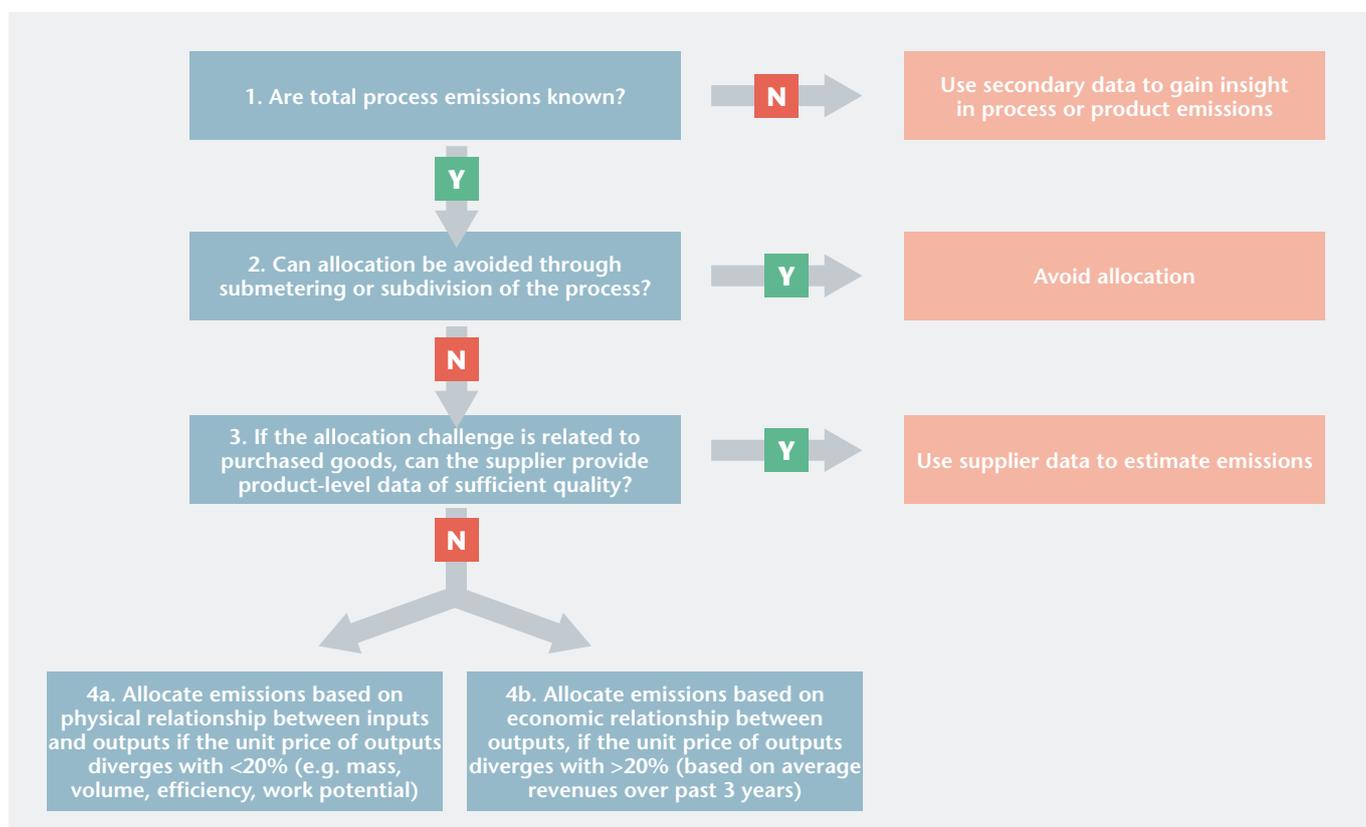
- General description of allocation methods:
- Physical allocation: allocation of emissions based on quantity of co-products: mass, volume, energy, number of units;
- Economic allocation: allocation of emission based on relative revenue of product (electricity, chemical, end-product) or entity (plant, business unit, company);
- Other allocation methods based on process characteristics: allocation of

emissions via alternative method, where relevant (for example work-potential for CHP generated electricity and steam).

GUIDANCE

- There is no single best allocation approach, as the best allocation approaches are different for different situations. The decision tree (Figure 5) shall be followed to increase consistency in allocation of emissions.
- To ensure compliance with guidance in other recognized standards (ISO, PAS 2050, GHG Protocol), system expansion is allowed for product inventories, while this option is not allowed for corporate inventories.
- While the guidance does not include system expansion as an option to allocate emissions for corporate inventories, it is accepted that secondary data (e.g. product-level GHG data) used by companies may be created using system expansion.

Figure 5 Decision Tree for Selecting an Allocation Method



Companies shall follow allocation guidance prescribed by relevant industry associations, if available (e.g.: PlasticsEurope, Eurochlor...)

STEP 1: DETERMINE TOTAL PROCESS EMISSIONS

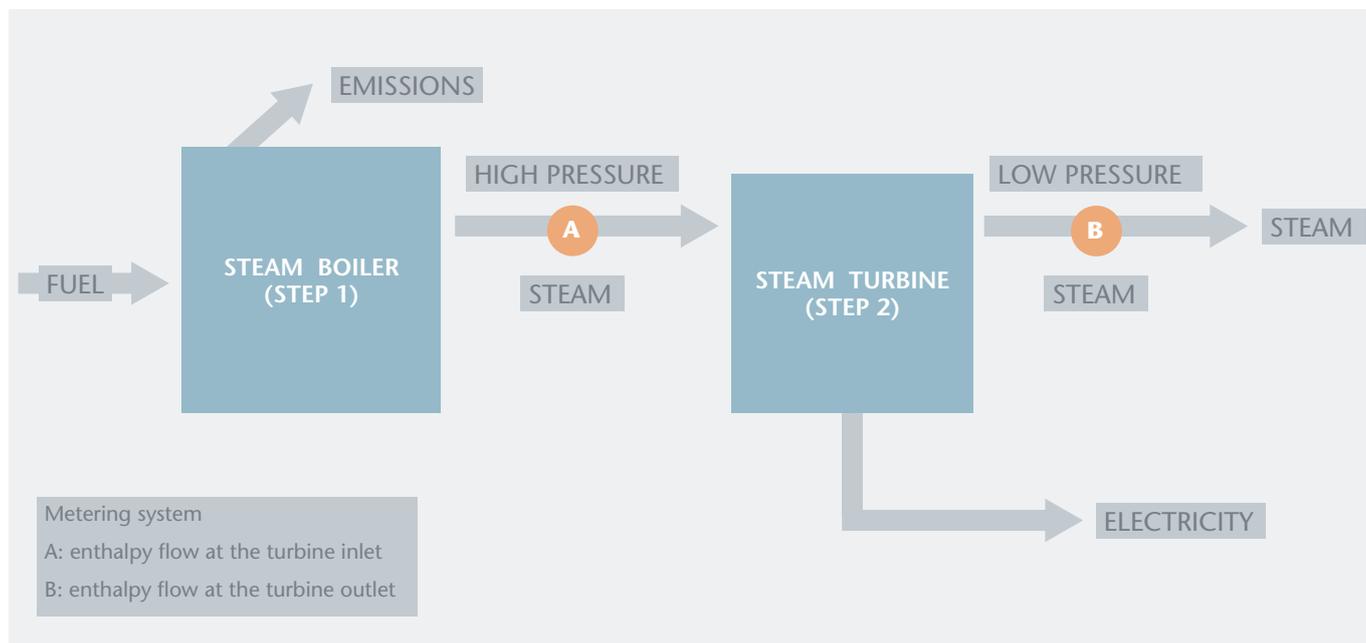
Before starting allocation, the total process emissions need to be identified. Independent of the allocation method selected, the sum of the allocated emissions shall always add up to 100%. In cases where the total process emissions cannot be determined, the

emissions related to the individuals processes or products can be estimated through the use of secondary data. It is often not feasible to identify the total emissions of processes occurring upstream or downstream. In these cases, companies may utilize secondary product-level data.

STEP 2: AVOID ALLOCATION THROUGH THE USE OF SUB-METERING OR PROCESS SUBDIVISION

Companies shall avoid allocation where possible. Sometimes this is feasible by installing sub-metering systems for energy consuming processes.

**Case Example:
Avoiding allocation by installing sub metering
systems for a two-step CHP process**



**STEP 3:
IF THE ALLOCATION CHALLENGE
IS RELATED TO PURCHASED
GOODS, AVOID ALLOCATION
THROUGH THE USE OF SUPPLIER
DATA**

Suppliers may be able to provide pre-allocated emissions data to the reporting company and disclose the allocation method used. Supply chain cooperation can be promoted by data exchange in the supply chain. Supplier allocation may be more practical as it may avoid the need for suppliers to report confidential business information. This can ensure that 100% process emissions will be allocated, avoiding under- or over counting.

Example: Emissions per MWh for conventional and renewable electricity can be provided by utility company. In some cases, adjustments to the delivered data may be required to make the scope and quality of the data consistent with the reporting company's requirements.

- E.g. Adding transmission losses where average grid factors have or excluded them.

Please note that in the case of CHP allocation for scope 1 reporting, no supplier is involved.

**STEP 4:
ALLOCATE EMISSIONS USING
A PHYSICAL OR ECONOMIC
ALLOCATION METHOD,
DEPENDING ON PROCESS
CHARACTERISTICS**

Economic allocation is especially suitable when:

- A co-product would not be produced without market demand for the primary product and/or other co-products;
- A co-product was a waste which has acquired value in the marketplace as a replacement for another product;
- Economic allocation can reflect the causal relationship between the

production of the outputs and the resulting emissions.

Economic allocation shall not be used if:

- Prices change significantly or frequently over time, and this cannot be compensated for by taking a 3-year average;
- Companies pay substantially different prices for the same product due to different negotiated prices;
- Prices are not well-correlated with underlying physical properties and GHG emissions (e.g., for luxury goods, products with high brand value, and products whose price reflects high research and development, marketing, or other costs, apart from production).

In these cases, emissions shall therefore be allocated to different outputs using physical allocation.

Examples of the use of different allocation methods

	Process	Allocation method
1	Waste disposal through incineration with heat recovery	Economic allocation
3	Salt production (co-product: water ~50°C)	Economic allocation
4	Combined Heat and Power: Allocation of emissions to electricity and steam	Efficiency method ¹⁴
5	Emissions related to the operations of a naphtha cracker	Companies follow allocation guidance provided by PlasticsEurope ¹⁵

4.2 Allocation of emissions from Combined Heat and Power (CHP) installations

A variety of methods were identified by participating companies that allocate emissions from CHP installations. Most often these included the work potential method or the efficiency method, although others were also used.

In the efficiency method, emissions are allocated based on the fuel required to produce the power and heat streams, using assumed efficiencies. In the work potential method, emissions are allocated based on the useful energy represented by electric power and heat, and defines useful energy on the ability of heat to perform work.

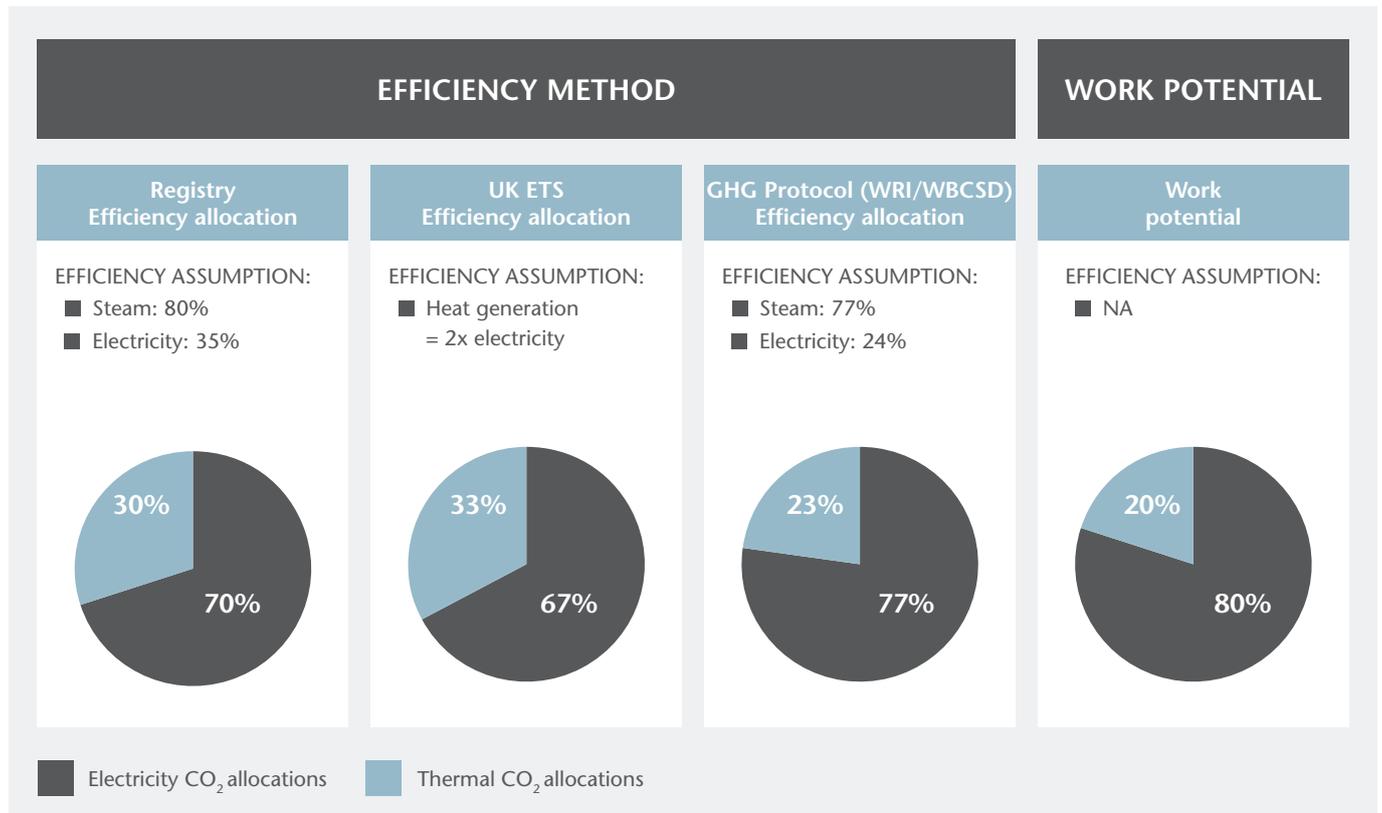
Inconsistency in the allocation of emissions from CHP installations is relevant for the chemical industry

because it can lead to significant differences in the resulting inventory of corporate emissions and create challenges for users of the reported information. The California Air Resources Board used a sensitivity analysis to suggest that the coexistence of different approaches and/or efficiency factors may lead to significant inconsistencies, as described in Figure 6 below.

14. See next section for an explanation of different CHP allocation methodologies

15. See http://www.plasticseurope.org/documents/document/20110421141821-plasticseurope_eco-profile_methodology_version2-0_2011-04.pdf

Figure 6 Sensitivity analysis by the California Air Resources Board indicates that the use of different approaches and/or efficiency factors may lead to significant inconsistencies



Sensitivity analysis for a CHP with a gross electricity to heat ratio of 1 : 0.96
 (source: www.arb.ca.gov/cc/ccei/presentations/ARBCogenApproach.pdf)

Most standards and regulations currently favor the use of the efficiency method when allocating CHP emissions as identified below

Preferred CHP emissions allocation method		
	Efficiency method	Work potential
GHG Protocol (WRI/WBCSD)	✓	(allowed, although not preferred)
ISO (1-40040-43)	✓	
U.S. EPA Climate Leaders	✓	
California Climate Action Registry	✓	
UK Emissions Trading Scheme	✓	
California Air Resources Board (ARB)	✓	
Australian Greenhouse & energy reporting act	✓	* only if heat is used to perform mechanical work
Product Category Standard for Electricity and Steam	✓	

For a detailed explanation of both the efficiency and work potential methods, please refer to the GHG Protocol CHP Guidance v1.0 at www.ghgprotocol.org

GUIDANCE:

Companies shall use the efficiency method to allocate CHP emissions where none of the steam outputs have very high pressure (> 80 bar) used for mechanical work or very low pressure (< 20 bar).

RATIONALE FOR GUIDANCE:

The efficiency method was chosen because of consistency with many other leading standards and practices.

ADDITIONAL GUIDANCE:

The efficiency method may misrepresent emissions in cases where steam produced has either very low (<20 bar) or very high pressure (>80 bar). For these applications, chemical companies shall apply the work

potential approach, which takes into account to what extent the produced energy is useful. In case the efficiency method is not applied, the reporting company shall provide the reasoning for not using the approach.

The emissions from CHP installations reported by involved companies shall always add up to 100% of total emissions generated by the CHP installation (i.e. it is necessary to agree upon the allocation method with suppliers/consumers of produced electricity, steam and/or heat).

GUIDING PRINCIPLES TO DETERMINE EFFICIENCY FACTOR

Companies shall follow agreed guiding principles to determine the efficiency factors to be used in the efficiency method:

1. Follow mandatory regulatory factors, if required to.
2. Use equipment-specific factors provided by equipment supplier, if available and compliant with quality criteria.
3. Use technology-specific efficiency factors from Product Category Rules, if relevant for the equipment used and if compliant with quality criteria. For an example of efficiency factors from a Power and Steam PCR see Figure 7.
4. For older equipment, these factors may prove not to be representative.
5. If more specific data is not known, use the following default factors: 80% for steam and 35% for electricity.

Figure 7 Technology-specific Efficiency Factors

Preferred CHP emissions allocation method				
Fuel type	Technology	Alternative heat efficiency (%)	Alternative electricity efficiency (%)	Illustrative CO ₂ emission allocation
Biofuel	Steam cycle, heat and power	90%	38%	29% 71%
	Steam cycle, heat and power, flue gas condensation	110%	38%	25% 75%
Waste	Steam cycle, heat and power	90%	35%	27% 73%
	Steam cycle, heat and power, flue gas condensation	100%	35%	25% 75%
Black coal	Steam cycle, heat and power	90%	46%	33% 67%
Natural gas	Steam cycle, heat and power	90%	47%	33% 67%
	Steam cycle, heat and power, flue gas condensation	105%	47%	70%
	Combined cycle, heat and power	90%	58%	38% 62%
Oil	Steam cycle, heat and power	90%	46%	33% 67%
Oil shale	Steam cycle, heat and power	86%	38.9%	30% 70%

Emissions allocated for a CHP with electricity to heat ratio of 1 : 0.96

(source: Product Category Rules for Power and Steam (ABB) <http://www.environdec.com/en/Product-Category-Rules/Detail/?Pcr=5802>)

5 Reporting GHG Emissions

Companies report their GHG emissions for a number of reasons. To comply with regulations, to participate in voluntary reporting programs such as the Carbon Disclosure Project (CDP), and to gain recognition by stakeholders for their GHG management activities. This section provides chemical companies with consistent guidance on how to report GHG information, enabling more comparable GHG inventories across companies within the same sector.

PART I

Issues addressed in Part I include:

1. Reporting on emissions from renewable sources
2. Reporting on offsets / unbundled energy certificates
3. Reporting on GHG emissions intensity
4. Reporting on recalculated base year emissions
5. Reporting on avoided GHG emissions
6. Reporting on quality and uncertainty of GHG emissions data

PART II

This section includes a standard reporting structure.

SUMMARY OF GUIDANCE:

- CO₂ emissions from renewable sources shall be reported separately,

while other emissions (N₂O, CH₄) from renewable sources are reported in the inventory.

- Offsets and unbundled energy certificates shall be reported outside the main inventory, to enable fair comparison of GHG reports.
- When calculating scope 1 and 2 GHG emissions intensity of chemical production, the reporting company shall not include scope 1 emissions related to sold energy.
- If the company compares the reported year's emissions with the past or a base year, the company shall make explicit what boundaries are chosen and what changes have occurred.
- The reporting company shall not report on avoided emissions within, or as part of, the company's Scope 1, 2 and 3 GHG inventory.
- The reporting company shall report emissions using a standard reporting structure, to ensure consistent reporting.

5.1 Reporting emissions from renewable sources

Emissions from biomass sources are typically compensated for by CO₂ absorbed during photosynthesis.

Therefore, many companies report zero emissions related to the combustion of biomass. Inconsistencies or confusion may arise if different companies apply

different methods or formats to report emissions from biogenic origin.

GUIDANCE:

CO₂ emissions from biomass shall be reported separately from the GHG emissions inventory.

RATIONALE FOR SELECTED BEST PRACTICE APPROACH:

The selected approach delivers the most transparency and completeness while ensuring consistency with other relevant GHG standards that are in use by companies.

ADDITIONAL GUIDANCE FOR APPLYING THE SELECTED APPROACH:

- CO₂ emissions from biogenic sources shall be reported as a separate line following the stated total emissions after adjustment for offsets.
- Any N₂O and/or CH₄ emissions shall be reported separately in the main inventory.
- Carbon emissions from biomass shall be reported with a zero CO₂ figure in the main GHG corporate report.

Emissions from Renewable Resources in Cradle-to-Gate Product-level Inventories

GUIDANCE:

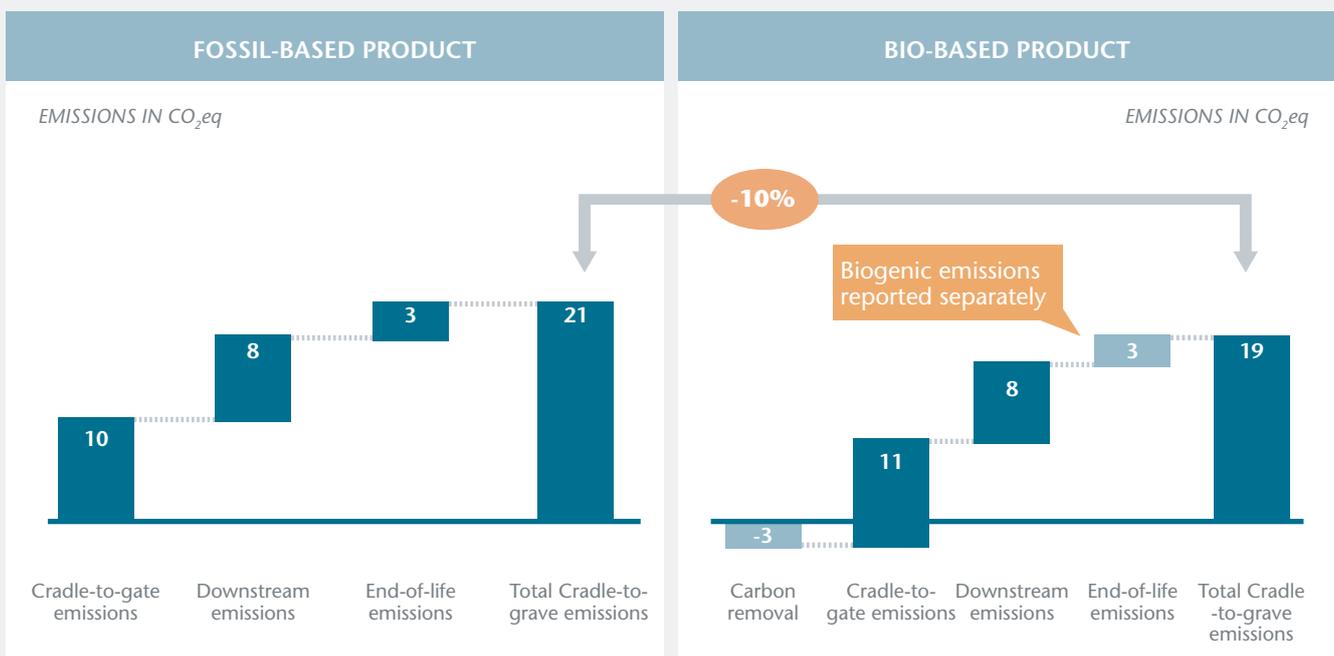
In the cradle-to-gate inventory of a product contained carbon and biogenic carbon removal shall be reported separately.

For biogenic content, the end-of-life impact is accounted for when the trees are cut, not when they are burned; while for fossil-based content, the end-of-life impact is only accounted for at the end-of-life phase of a product. This inconsistency has an unfavourable impact on the cradle-to-gate impact of bio-based materials and may hamper the shift of the chemical industry to renewable materials. Therefore, this guidance is relevant for reporting product cradle-to-gate GHG inventories, which are increasingly being asked for as part of a product specification.

Case Example 1:

In a full Cradle-to-Grave inventory, any advantages or disadvantages (if available) from the use of bio-based materials are sufficiently clear

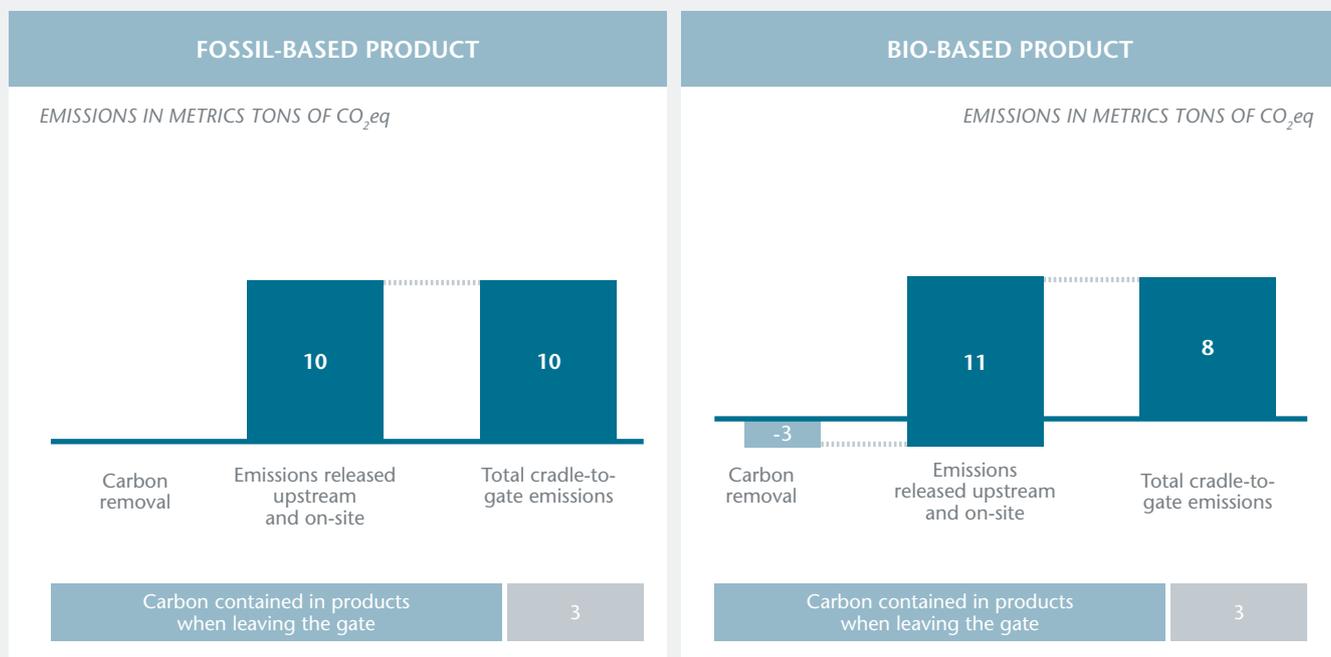
CRADLE-TO-GRAVE FOOTPRINT COMPARISON OF FOSSIL-BASED VS. BIO-BASED PRODUCTS



Case Example 2:

To avoid misleading information, contained carbon and biogenic carbon removal figures shall be reported in Cradle-to-Gate product inventories as separate figures.

REPORTING FORMAT FOR BIO-BASED CONTENT IN A CRADLE-TO-GATE INVENTORY



5.2: Reporting benefits from offsets / unbundled energy certificates

Companies purchase offsets / unbundled certificates to compensate for emissions generated by their activities. Inconsistencies and confusion may occur if different approaches are used by different companies with regard to the reporting of impacts from offsets.

GUIDANCE:

The reporting company shall report all offsets separately from their Scope 1 and 2 emissions. This includes both offsets with certificates and without.

ADDITIONAL GUIDANCE FOR APPLYING THE SELECTED APPROACH:

- Any regulatory reporting requirements must be met.
- Following the guidance in the GHG Protocol Corporate Standard, companies shall report their emissions separately from offsets used to meet any GHG reduction targets that are established, rather than providing a net figure.
- Companies shall transparently mention the origin of reported offsets.
- Unbundled certificates shall be reported as separate offsets (i.e. do not adjust emission factors).
- Certificates that are purchased by the supplier of electricity (i.e. the supplier purchases certificates on your behalf) shall be reported as separate offsets.
- Emissions from purchased energy bundled to a Renewable Energy Certificate (REC) shall be reported based on the emission factor given in the REC.
- If a company sells certificates it received for emission reductions realized within its reporting boundaries, it shall report an "offset" with a positive impact.

5.3 Reporting on GHG emissions intensity

Emissions related to electricity generated that is not consumed by the reporting company are included in scope 1. Emissions intensity is the measure of greenhouse gas emissions produced per unit of output (most commonly measured by physical output or economic output).

Companies reporting scope 1 and 2 emissions intensity (per produced quantity of chemical product) have a disadvantage when scope 1 emissions related to energy sale are included in comparisons.

GUIDANCE:

When reporting GHG emissions intensity for chemical production as (scope 1 + scope 2 GHG emissions) / produced quantity of product and/or service, the reporting company shall exclude scope 1 emissions originating from generating energy that is sold.

RATIONALE FOR SELECTED BEST PRACTICE APPROACH:

As reports on GHG emissions intensity compare the total amount of emissions from specific activities to the output of these activities, it is important that:

- Both activity emissions and activity outputs have the same basis;

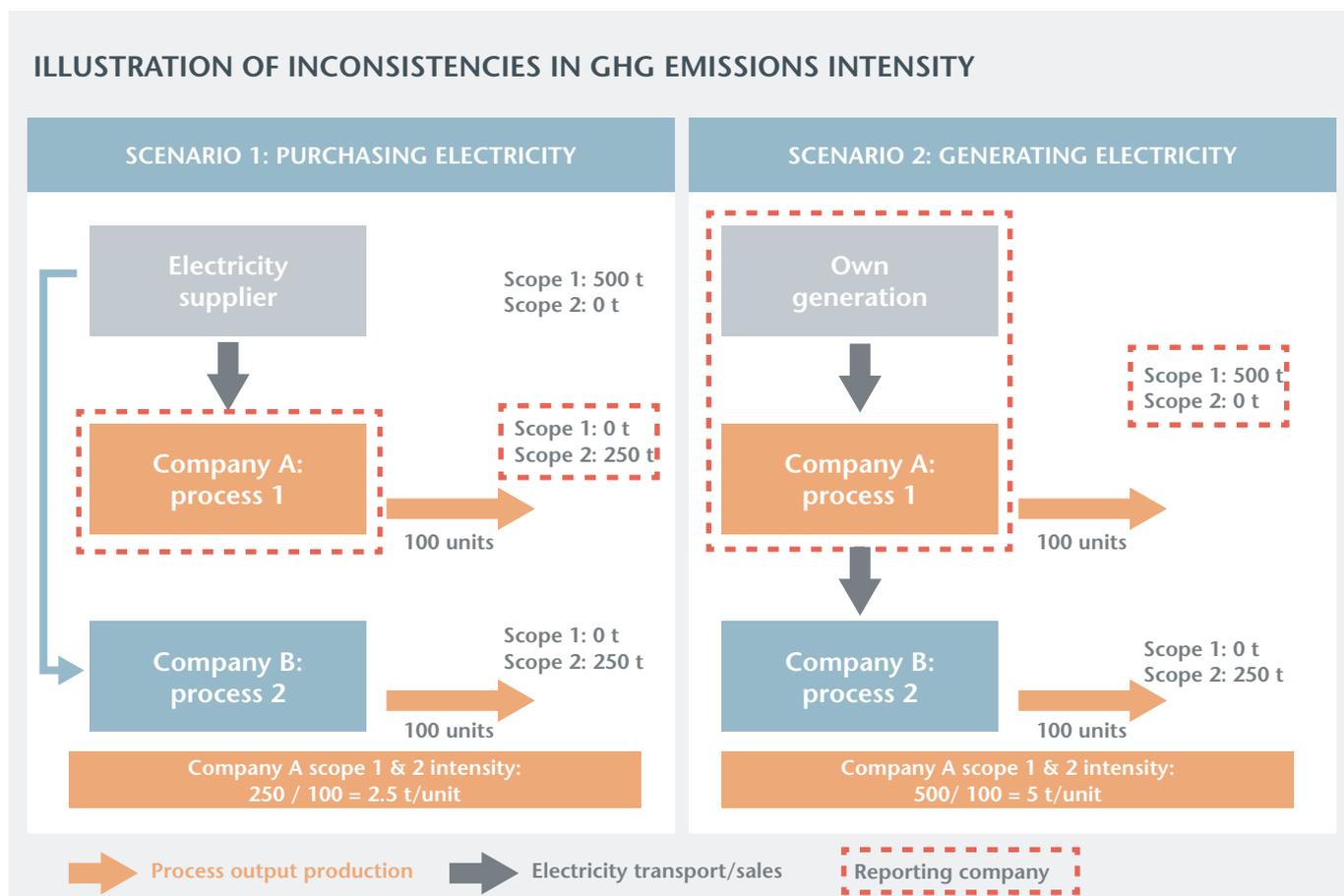
- Companies make explicit on what scope the intensity reporting is based.

ADDITIONAL GUIDANCE FOR APPLYING THE SELECTED APPROACH:

- If intensity calculations are based on total company revenues, companies shall include scope 1 emissions originating from generating energy that is sold. This allows fair comparison of companies generating and selling surplus electricity and companies generating and purchasing not more than the required amount.

Illustrative Example:

Please note that while this example is about electricity, a similar approach can be followed when evaluating emission intensity of steam.



5.4 Reporting recalculated base year emissions

Following structural changes in the organization of a company, emissions in the base year in reports are adjusted by some of the participating companies (in case of methodology changes or errors, emissions in the base year are always recalculated). The use of the same logic for base year adjustment by all reporting companies eliminates inconsistent reporting.

GUIDANCE:

If the company compares the reported year's emissions with the past or a base year, the company shall make explicit what boundaries are chosen and what changes have occurred.

RATIONALE FOR SELECTED BEST PRACTICE APPROACH:

Reporting on performance versus a base year is not required. Therefore, companies reporting on performance versus a base year will have the most like-for-like comparisons and comparable inventories when they transparently report what is included and excluded.

ADDITIONAL GUIDANCE FOR APPLYING THE SELECTED APPROACH:

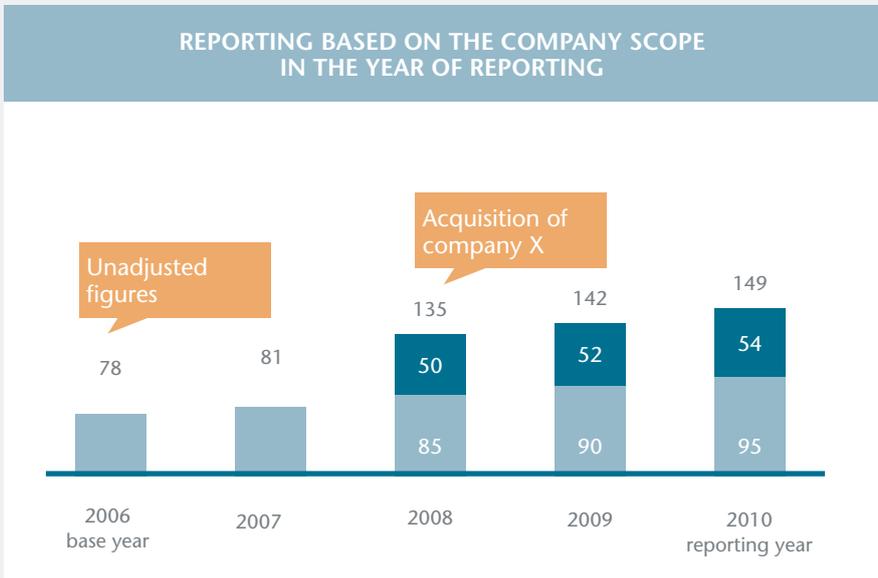
- If the reporting company publically compares its emissions versus the past or versus a base year (e.g. in its sustainability report), the reporting

company shall make explicit what boundaries are chosen and what changes have occurred¹⁷.

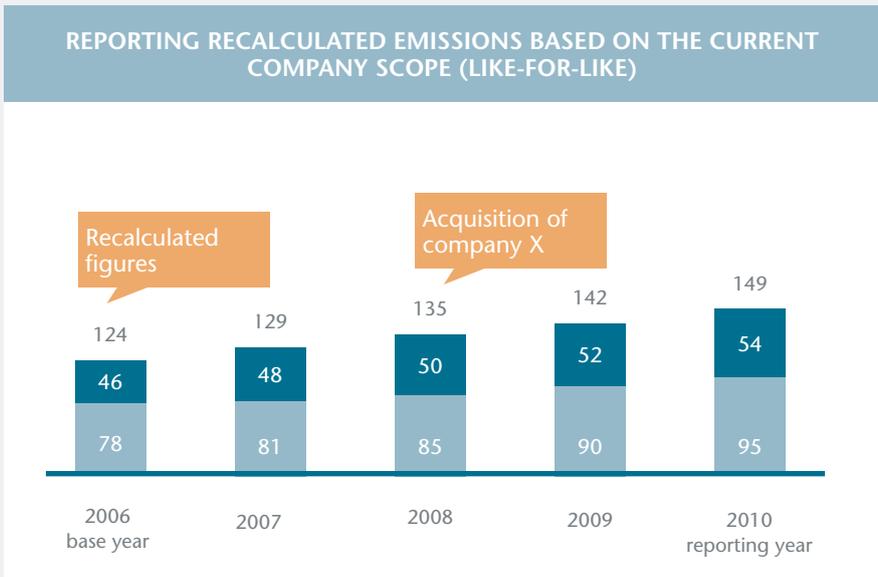
- Emissions in the year of reporting shall represent the absolute emissions generated by the reporting company in that year (i.e. representing the structure of the company in the year of reporting).
- Reporting on emission levels versus a base year is not mandatory; the selection of the base year and approach for reporting is accepted to differ when comparing different chemical companies because of differences in:
 - o the availability and quality of historic data on emissions;
 - o company objectives.
- If a company reports on performance versus a base year, it may choose to do this by reporting emissions based on the company boundaries in the year of reporting and/or based on a like-for-like approach, as long as the reporting company makes explicit what is included and excluded and transparently indicates:
 - o The reporting boundaries chosen (organizational boundaries in year of reporting or like-for-like);
 - o Changes in company boundaries or structure since the base year if these impacted performance vs. objectives;
 - o The estimated impact of these changes on the performance vs. the target.
- In case of omissions, errors or methodology changes, companies shall adjust reported historic figures on a best effort basis.
- Recalculating figures for only the base year may suffice if a company only reports vs. the base year (i.e. not on years in between).
- Companies may report absolute, non-adjusted figures and/or adjusted emissions, depending on the company's objectives.

¹⁷ — Source: GHG Protocol, p.34, Appendix E to the GHG Protocol: Base year recalculation methodologies for structural changes

Illustrative Example



- The company reports emissions based on the boundaries of the organization in the year of reporting.
- The company reports changes in company boundaries or structure to explain material changes in its performance vs. objectives (e.g. in this example the acquisition in 2008).



- The company reports emissions based on the current boundaries of the organization (like-for-like).
- The company reports changes in company boundaries or structure to explain material changes in its performance vs. objectives (e.g. in this example the acquisition in 2008).

ACQUIRED COMPANY
 ORIGINAL COMPANY SCOPE

5.5 Reporting on Avoided Emissions

Companies in the chemical sector often produce and market products that provide the opportunity to avoid future emissions (e.g. insulation materials, lighter constructions, fuel additives, etc.). There is currently no consistent method to determine the amount of emissions that can be avoided through the use or application of products.

GUIDANCE:

The reporting company shall not report avoided emissions as part of the corporate scope 1, 2 and 3 GHG inventory.

RATIONALE FOR SELECTED BEST PRACTICE APPROACH:

Calculating avoided emissions requires an emission level for comparison and there is no consistent guidance yet available to determine these comparison levels. Therefore, companies report absolute emissions generated and do not include avoided emissions information in the corporate GHG inventory.

ADDITIONAL GUIDANCE:

- Companies may choose a methodology for measuring avoided emissions, but shall not include this in the corporate GHG inventory.
- The WBCSD and the ICCA are developing case studies on avoided emissions and will develop guidelines for reporting avoided emissions in the future.

5.6 Reporting on quality and uncertainty of GHG emission data

GUIDANCE:

While the value of quantitative assessment of the quality and uncertainty of the inventory is recognized, it is expected that such an analysis requires substantial efforts from the reporting company.

- Quantitative reporting on quality and uncertainty has therefore not been made a mandatory component of this guidance.
- Chemical companies shall however offer qualitative information on assumptions and allocation methods used to calculate emissions.
- Companies must always meet local legal or regulatory requirements.
- Further to the clarifications on assumptions and allocation methods, companies shall report for each inventory and category what data has been used to calculate emissions. We suggest the following template for reporting on data types used for scope 1, 2 & 3 GHG inventories.

Illustrative Example

Category	Activity data			Emission factor			Other comments & observation
	Measurement of actual activity	Modeled using company specific data	Secondary data	Measurement of actual activity	Modeled using company specific data	Secondary data	
Scope 1	✓				✓	✓	
Scope 2	✓				✓	✓	
Scope 3 categories						✓	
1. Purchased goods & services		✓	✓				
2. Capital goods	✓	✓					
3. Fuel & energy related activities			✓		✓	✓	
etc...							

PART II

Reporting Structure

While guidance on reporting is provided throughout the GHG accounting standards, there is no consistent reporting structure to companies' scope 1, 2 and 3 emissions. Inconsistencies arise across companies and therefore the use of a consistent template and structure for reporting corporate GHG emissions will enable better comparison and interpretation of the information by stakeholders.

GUIDANCE:

The reporting company shall report scope 1, 2 and 3 emissions using the standard reporting structure, to ensure consistent reporting. The reporting company shall meet any regulatory requirements first. The standard reporting structure is shown in Figure 8.

GENERAL REPORTING GUIDANCE

- The reporting company shall subdivide figures into emissions attributable to its:
 - o Scope 1 (own operations);
 - o Scope 2 (the generation of purchased energy such as electricity, steam or heat by mode);
 - o Scope 3 (the required value chain emissions categories indicated in this guidance document, broken down by category).

Figure 8 Standard Reporting Structure

	CO ₂	N ₂ O	CH ₄	HFCs	PFCs	SF ₆	CO ₂ e	Offsets	Total incl. offsets	Biogenic emissions
Scope 1										
Site / BU 1										
Site / BU 2										
Site / BU 3										
...										
Scope 1 total										
Scope 2										
Site / BU 1										
Site / BU 2										
Site / BU 3										
...										
Scope 2 total										
Total Scope 1+2										
Scope 3										
1. Purchased goods & services	Not mandatory to report emissions for individual GHGs									
2. Capital goods										
3. Fuel and energy-related activities										
4. Upstream transportation & distribution										
5. Waste generated in operations										
6. Business travel										
7. Employee commuting										
8. Upstream leased assets										
9. Downstream transportation/distribution										
10: Processing of sold products						N/A				
11. Use of sold products – direct emissions										
12. End-of-life treatment of sold products										
13: Downstream leased assets						N/A				
14: Franchises						N/A				
15: Investments						N/A				

Emission totals required to report

X See bullet points for relevant guidance

- The reporting of a total for scope 3 emissions is not required.
- The reporting company may further subdivide emissions information into:
 - o Emissions attributable to combustion of (1) fossil fuels, (2) biomass (for which the CO₂ emissions are reported separately from the scopes);
 - o Emissions attributable to (1) energy generated for own use, (2) generated energy that is sold or transferred to another organization.
- The reporting company may report on emissions from GHGs not covered by the Kyoto Protocol (e.g., CFCs, NO_x, VOCs). If companies report on these GHGs, the emissions shall be reported separately from the scopes.
- Details on chosen reporting methods applied may be provided on an alternative location such as the company website rather than in the report, as long as a clear explanation and reference is provided.

ADDITIONAL GUIDANCE

- 1 Companies may further subdivide emissions data where this aids transparency
 - o e.g. by business units / facilities, country, source types (stationary combustion, process, fugitive, etc.), and activity types (central power and steam production, transportation, generation of electricity that is sold, etc.). Companies shall report material emissions for each of the six GHGs separately in metric tonnes. If emissions for a certain GHG are not material, companies should report that they are not material in the appropriate column.
- 2 Companies shall report a total figure for emissions before any impacts from offset emissions:
 - o Positive impacts are reported in case offsets received for emission reductions realized within a companies reporting boundaries are sold;
 - o Unbundled certificates shall be reported as offsets (i.e. do not adjust emission factors, as impacts take place outside the company's boundary), also if the certificates are purchased by the supplier of electricity (supplier purchases certificates on your behalf).
- 3 Companies shall report a separate total including the impacts of offsets, but excluding CO₂ emissions from biomass.
- 4 Companies shall report CO₂ and other GHG emissions from biomass separately from the scopes in separate columns:
 - o Fugitive CO₂ emissions from water treatment shall be reported separately from scope 1 & 2 if the emissions originate from biomass;
 - o Fugitive fossil emissions shall be included in scope 1 & 2 reporting
- 5 Companies shall report metric tonnes of CO₂e emissions, which are calculated based on the figures in previous columns using a time frame of 100 years
- 6 Companies shall report total GHG emissions (CO₂, CH₄, N₂O, HFCs, PFCs, and SF₆) reported in CO₂e for each relevant scope 3 category, and may additionally report these emissions by separate greenhouse gas.
- 7 Companies shall report emissions for the selected scope 3 categories in CO₂e, and may additionally report the 6 different GHG for these emissions.

Appendix A

Default Data Sources for Scope 3

In the development of this guidance, a number of sources of data and default calculation tools were used. The data sources below can be used as a guide to assist companies when more specific or representative data is not available.

Scope 3 category	Default data sources
Category 1: Purchased goods & services	<ul style="list-style-type: none"> The UK Department for Environment, Food and Rural Affairs (DEFRA) publishes upstream GHG emission factors for different products and services: archive.defra.gov.uk/environment/business/reporting/pdf/annex13-supply-chain-emissions-110405.pdf
Category 2: Capital goods	<ul style="list-style-type: none"> Default composition of capital goods based on US Department of Energy National Renewable Energy Laboratory (NREL) study: www.nrel.gov/docs/fy00osti/27715.pdf The UK Department for Environment, Food and Rural Affairs (DEFRA) publishes upstream GHG emission factors for different products and services: archive.defra.gov.uk/environment/business/reporting/pdf/annex13-supply-chain-emissions-110405.pdf
Category 3: Fuel- and energy-related activities (not included in scope 1 or 2)	<ul style="list-style-type: none"> Companies are encouraged to use region specific T&D loss rates, see the US Energy Information Administration (EIA): www.eia.gov/tools/faqs/faq.cfm?id=105&t=3 For combustion emission factors, please see the GHG protocol Cross Sector Calculation tool for purchased electricity: www.ghgprotocol.org/calculation-tools/all-tools
Category 4: Upstream transportation & distribution	<ul style="list-style-type: none"> For transport shares percentage, see European Chemical Industry Council (cecic), Guidelines for Measuring and Managing CO₂ Emissions from Freight Transport Operations, 2011: http://www.cecic.org/Documents/IndustrySupport/Transport-and-Logistics/Best%20Practice%20Guidelines%20-%20General%20Guidelines/Cefic-ECTA%20Guidelines%20for%20measuring%20and%20managing%20CO2%20emissions%20from%20transport%20operations%20Final%2030.03.2011.pdf See GHG Protocol Cross Sector Calculation Tool for Transport or Mobile Sources: www.ghgprotocol.org/calculation-tools/all-tools Default emission factors used are based on European Chemical Industry Council (cecic), Guidelines for Measuring and Managing CO₂ Emissions from Freight Transport Operations, 2011: <ul style="list-style-type: none"> The default factor for road transport is based on an average load factor of 80% of the maximum vehicle payload and 25% of empty running.

<p>Category 5: Waste generated in operations</p>	<ul style="list-style-type: none"> • Default factors for the end of life treatment of products (80% to landfill, 20% incinerated) and default carbon content of chemical waste (80%, based on petroleum products, solvents, plastics) were estimated based on Intergovernmental Panel on Climate Change (IPCC) figures (page 5): www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf • For landfill, it is assumed that, except for durable plastics, 50% of the contained carbon is converted into CO₂ (GWP=1) and 50% into methane (GWP=25), in line with measurements by Oxford University: users.ox.ac.uk/~ayoung/LF/cwm039a.pdf • For landfilling of durable plastics default information, see United States Environmental Protection Agency information: www.epa.gov/climatechange/waste/downloads/Plastics.pdf from www.epa.gov/climatechange/waste/calculators/Warm_home.html.
<p>Category 6: Business travel</p>	<ul style="list-style-type: none"> • Default emissions factors for business travel, see: <ul style="list-style-type: none"> o GHG Protocol Calculation Tool for Emissions from Transport or Mobile Sources: http://www.ghgprotocol.org/calculation-tools/all-tools o UK Department of Environment, Food, and Rural Affairs (UK Defra) Information: http://archive.defra.gov.uk/environment/business/reporting/pdf/110707-guidelines-ghg-conversion-factors.pdf o United States Environmental Protection Agency information: www.epa.gov/climateleaders/documents/resources/commute_travel_product.pdf
<p>Category 7: Employee commuting</p>	<ul style="list-style-type: none"> • Default emissions factors for employee commuting, see: <ul style="list-style-type: none"> o GHG Protocol Calculation Tool for Emissions from Transport or Mobile Sources: http://www.ghgprotocol.org/calculation-tools/all-tools o UK Department of Environment, Food, and Rural Affairs (UK Defra) information: http://archive.defra.gov.uk/environment/business/reporting/pdf/110707-guidelines-ghg-conversion-factors.pdf o United States Environmental Protection Agency information: (use the link that is already there) www.epa.gov/climateleaders/documents/resources/commute_travel_product.pdf
<p>Category 8: Upstream leased assets</p>	<ul style="list-style-type: none"> • Average emission factor 210 kg CO₂eq per m² based on energy use of 300 kWh/m² and emissions of 0.7 kg CO₂eq/KWh <ul style="list-style-type: none"> o For Europe 250 kWh/m² (standard office building) (source: Institut Wohnen und Umwelt GmbH, Dr. Ing. Jens Knissel) o For USA and Asia: 340 kWh/m² • Emission factors calculated based on the relevant part of the lessor's scope 1 and 2 emissions
<p>Category 9: Downstream transportation & distribution</p>	<ul style="list-style-type: none"> • For default transport shares %: see European Chemical Industry Council (cefic), Guidelines for Measuring and Managing CO₂ Emissions from Freight Transport Operations, 2011. See also GHG Protocol Cross Sector Calculation Tool for Transport or Mobile Sources: www.ghgprotocol.org/calculation-tools/all-tools
<p>Category 11: Use of sold products</p>	<ul style="list-style-type: none"> • For global warming potential values, see the GHG Protocol on Global Warming Potential Values: www.ghgprotocol.org/files/ghgp/tools/Global-Warming-Potential-Values.pdf • For combustion emissions, see GHG Protocol Tool for Stationary Combustion Emissions: www.ghgprotocol.org/calculation-tools/all-tools
<p>Category 12: End-of-life treatment of sold products</p>	<ul style="list-style-type: none"> • For default carbon content of chemical waste (assumption of 80% based on Petroleum products, solvents, plastics) estimated based on Intergovernmental Panel on Climate Change (IPCC) figures, see www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf • For landfill estimates (assumption that 50% of the contained carbon is converted into CO₂ (GWP=1) and 50% into methane (GWP=25), based on measurements by Oxford University: users.ox.ac.uk/~ayoung/LF/cwm039a.pdf
<p>Category 15: Investments</p>	<ul style="list-style-type: none"> • Default factors not applicable

Appendix B

Categories of Biomass

When reporting emissions from renewable sources, companies should be able to follow clear guidance on what is included in the definition of biomass. For the purpose of this standard companies shall follow the definitions provided by IPCC & IEA.

ADDITIONAL INFORMATION: FOUR CATEGORIES OF BIOMASS (IPCC & IEA)			
1. Solid biomass	2. Liquid biomass	3. Gas biomass	4. Other non-fossil fuels
<ul style="list-style-type: none"> ■ Wood/wood waste ■ Sulphite lyes (black liquor) ■ Other primary solid Biomass ■ Charcoal 	<ul style="list-style-type: none"> ■ Biogasoline ■ Biodiesels ■ Other liquid biofuels 	<ul style="list-style-type: none"> ■ Landfill gas ■ Sludge gas ■ Syngas or natural gas derives from the gasification (by another company) of i.e. wood or waste ■ Other biogas 	<ul style="list-style-type: none"> ■ Municipal wastes (biomass fraction)

- CO₂ emissions from waste water treatment and fermentation processes are treated in the same way as other CO₂ emissions: emissions originating from fossil carbon are included in scope 1 and 2 and emissions originating from biomass are reported separately.
- Emissions from dehydration and/or drying process of sewage sludge should always be reported notwithstanding the exclusion of fugitive emissions from biomass-origin waste water treatment.
- CO₂ emissions from peat burning shall be included as emissions from fossil fuel burning.

Appendix C

Glossary

Companies are encouraged to review the glossaries of terms and definitions in the GHG Protocol Standards.

FINANCIAL LEASE

A lease that transfers substantially all the risks and rewards of ownership to the lessee and is accounted for as an asset on the balance sheet of the lessee; also known as a capital or financial lease; leases other than capital/financial/finance leases are operating/operational leases.

GHG INTENSITY

The measure of greenhouse gas emissions produced per unit of output (most commonly measured by physical output or economic output)

GHG OFFSETS

Offsets are discrete GHG emission reductions outside the company's boundary used to compensate for (i.e. offset) GHG emissions inside the company boundary; unbundled certificates are impacts on GHG emissions that take place outside the company boundary

INTERMEDIATE PRODUCTS/GOODS

Materials, components, and parts that a company purchases to process, transform, or include in another product (source: GHG Protocol Scope 3 Standard)

JOINT ARRANGEMENTS

When two or more companies jointly own or are responsible for a company's operations

Primary data: data from specific activities within a company's value chain (source: GHG Protocol Scope 3 Standard)

- For example: Electricity consumption of own machinery, footprint of direct electricity supplier

RENEWABLE ENERGY

Energy taken from sources that are inexhaustible, e.g. wind, water, solar, geothermal energy, and sustainably managed biofuels (source: GHG Protocol Corporate Standard)

Secondary data: data that is not from specific activities within a company's value chain (source: GHG Protocol Scope 3 Standard)

- For example: National average grid electricity emission factors, generic life-cycle analysis data from eco-invent databases

VALUE CHAIN

All upstream and downstream activities associated with the operations of the reporting company, including the use of sold products by consumers and the end-of-life treatment of sold products after consumer use (source: GHG Protocol Scope 3 Standard)

Appendix D

Overview of reviewed documents

The following documents were reviewed to prepare the guidance in this document.

1. International Environmental Product Declaration System, Product Category Rules CPC 171 & 173 Electricity, Steam and Hot and Cold Water Generation and Distribution, 2011-12-05.
2. American Petroleum Institute, Compendium of GHG emissions methodologies for the Oil and Natural Gas industry. 2009
3. British Standards Institute, Guide to PAS 2050: 2011, How to carbon footprint your products, identify hotspots and reduce emissions in your supply chain. 2011
4. British Standards Institute, Specification for the assessment of the life cycle greenhouse gas emissions of goods and services (PAS 2050:20011). 2011
5. California Air Resources Board, Cogeneration: Proposed Approach for Mandatory Greenhouse Gas Emissions Reporting. 2007
6. Carbon Disclosure Project (CDP), CDP Guidance for responding companies. 2012
7. Common Carbon Metric, Protocol for Measuring Energy Use and Reporting Greenhouse Gas Emissions from Building Operations (draft). 2010
8. Directorate-General for the Environment, Company GHG Emissions Reporting – a Study on Methods and Initiatives Revised Final Report. 2010
9. European Commission, A renewed EU strategy 2011-14 for Corporate Social Responsibility. 2011
10. European Economic Community (EEC), Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC. 2004
11. International Council of Chemical Associations (ICCA), Innovations for Greenhouse Gas Reductions. 2009
12. International Council of Forest and Paper Associations (ICFPA), Calculation Tools for Estimating Greenhouse Gas Emissions from Pulp and Paper Mills. 2005
13. International Organization for Standardization (ISO), Environmental management — Life cycle assessment — Principles and framework (ISO 14040). 2006
14. International Organization for Standardization (ISO), Environmental management — Life cycle assessment — Requirements and guidelines (ISO 14044). 2006
15. The European Chemical Industry Council (cecic), Guidelines for Measuring and Managing CO2 Emission from Freight Transport Operations. 2011
16. California Climate Action Registry, Power Generation/ Electric Utility Reporting Protocol. 2009
17. California Environmental Protection Agency Air Resources Board Mandatory Greenhouse Gas Reporting – 2010 Regulation. 2010
18. Department of Climate Change and Energy Efficiency, Australian Government, Technical Guidelines for the estimation of greenhouse gas emissions by facilities in Australia. 2011
19. International Financial Reporting Standards (IFRS), 11 Joint Arrangements. 2011
20. International Sustainability and Carbon Certification (ISCC), GHG Emissions Calculation Methodology and GHG Audit. 2011
21. IPIECA, American Petroleum Institute (API), International Association of Oil and Gas Producers (OGP), Petroleum industry guidelines for reporting greenhouse gas emissions, 2nd edition. 2010

22. North Carolina Division of Air Quality, Greenhouse Gas Emissions Guidelines Stationary Combustion Sources. 2009
23. PwC, Practical guide to IFRS Joint arrangements: a new approach to an age-old business issue. 2011
24. UK Department for Environment, Food and Rural Affairs (Defra) 2011 Guidelines to Defra/DECC's Conversion Factors for Company Reporting. 2011.
25. US Environmental Protection Agency Climate Leaders, Direct Emissions from Stationary Combustion Sources. 2008
26. US Environmental Protection Agency Climate Leaders, Indirect Emissions from Purchases/Sales of Electricity and Steam. 2008
27. World Resources Institute/World Business Council for Sustainable Development, GHG Protocol: Update on GHG Protocol Power Accounting Guidelines and Introduction to Technical Working Groups. 2011
28. World Resources Institute/World Business Council for Sustainable Development, GHG Protocol: Allocation of GHG Emissions from a Combined Heat and Power (CHP) Plant. 2006
29. World Resources Institute/World Business Council for Sustainable Development, GHG Protocol: Base year recalculation methodologies for structural changes. 2005
30. World Resources Institute/World Business Council for Sustainable Development, GHG Protocol: A Corporate Accounting and Reporting Standard Revised Edition. 2004
31. World Resources Institute/World Business Council for Sustainable Development, GHG Protocol: Corporate Value Chain (Scope 3) Accounting and Reporting Standard. 2011
32. World Resources Institute/World Business Council for Sustainable Development, GHG Protocol: Emissions from Use of Purchased Electricity, Heat and Steam Guidance. 2006
33. World Resources Institute/World Business Council for Sustainable Development, GHG Protocol: Calculation tool for emissions from transport or mobile sources. 2011
34. World Resources Institute/World Business Council for Sustainable Development, GHG Protocol: Calculation tool for emissions from stationary combustion. 2010
35. World Resources Institute/World Business Council for Sustainable Development, GHG Protocol: Guidelines for Quantifying GHG Reductions from Grid-Connected Electricity Projects. 2007
36. World Resources Institute/World Business Council for Sustainable Development, GHG Protocol: Indirect CO₂ Emissions from the Consumption of Purchased Electricity, Heat, and/or Steam. 2007
37. World Resources Institute/World Business Council for Sustainable Development, GHG Protocol: Product Life Cycle Accounting and Reporting Standard. 2011

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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.

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