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Organisation Environmental Footprint Guide

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Executive Summary

The Organisation Environmental Footprint (OEF) is a multi-criteria measure of the environmental performance of a goods/services providing organization from a life cycle perspective. This includes companies, public administrative entities, territories, and other bodies. This document provides guidance on how to calculate an Organisation Environmental Footprint, as well as how to create sector-specific methodological requirements for use in Organisation Environmental Footprint Sector Rules (OFSRs).

Context

This work relates to one of the building blocks of the Flagship initiative of the Europe 2020 Strategy – "A Resource-Efficient Europe." The European Commission's "Roadmap to a Resource Efficient Europe"[1] (European Commission 2011) proposes ways to increase resource productivity and to decouple economic growth from both resource use and environmental impacts, taking a life-cycle perspective. It states specifically as one of the objectives to: "Establish a common methodological approach to enable Member States and the private sector to assess, display and benchmark the environmental performance of products, services and companies based on a comprehensive assessment of environmental impacts over the life-cycle ('environmental footprint')". The European Council also invited the Commission to develop supporting methodologies.[2] Thus, the Product and Organisation Environmental Footprint (OEF) project was initiated with the aim of developing a harmonized European methodology for environmental footprint studies that can accommodate a broader suite of relevant environmental performance criteria using a life cycle approach.

The life cycle approach takes into consideration all relevant environmental interactions associated with a good, service, activity, or entity. In other words, the life cycle approach requires attention to impacts that occur along the entire life cycle, i.e. from the level of primary resource extraction through processing, distribution, use, and eventual disposal or reuse phases. Such an approach is essential to effective management because important environmental effects may occur "upstream" or "downstream", and hence may not be immediately evident. This approach is also essential to making transparent any potential trade-offs between different types of environmental impacts associated with specific management decisions to help avoid unintended shifting of burdens.

Objectives

Depending on the intended application, Organisation Environmental Footprint (OEF) studies may be gate-to-gate, cradle-to-gate, or cradle-to-grave assessments. Organisation Environmental Footprint information is produced for the overarching purpose of seeking to reduce the environmental impacts associated with organisational activities, taking into account supply chain activities. This document aims at providing detailed technical guidance on how to conduct an Organisation Environmental Footprint study. Organisation Environmental Footprint studies may be used for a variety of purposes, including: benchmarking and performance tracking; least environmental cost sourcing (i.e. supply chain

[1] European Commission 2011: COM(2011) 571 final: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Roadmap to a Resource Efficient Europe

management); product/service design-for-environment considerations; mitigation activities; and participation in either voluntary or mandatory programs. To the extent possible, the OEF should also be applicable within the context of Eco-management and Audit Schemes (EMAS) reporting.

Organisation Environmental Footprint Sector Rules (OFSRs) are a necessary extension of and complement to the more general guidance for Organisation Environmental Footprint studies provided in this document. As they are developed, OFSRs will play an important role in increasing the reproducibility, consistency, and relevance of Organisation Environmental Footprint studies. OFSRs will facilitate focusing on the most important parameters, thus also possibly reducing time, efforts, and costs for completing an OEF study. In addition to general guidance and requirements for OEF studies, this document therefore also specifies the requirements for development of Organisation Environmental Footprint Sector Rules.

Process and Results

Each requirement for Organisation Environmental Footprint studies specified in this methods guide has been chosen taking into consideration the recommendations of similar, internationally recognized organisational environmental accounting methods and guidance documents. Specifically, the methodology guides considered were:

- ISO 14064: Greenhouse gases -- Part 1, 2 and 3;
- ISO/WD TR 14069: GHG -- Quantification and reporting of GHG emissions for organisations;
- ILCD: International Reference Life Cycle Data System;
- Corporate Accounting and Reporting Standards, Greenhouse Gas Protocol (WRI/ WBCSD);
- Bilan Carbon;
- DEFRA - Carbon Disclosure Project (CDP);
- CDP Water;
- Global Reporting Initiative (GRI).

Although such documents align closely on much of the methodological guidance they provide, it is noteworthy that discrepancies and/or lack of clarity remain on a number of important decision points, which reduces the consistency and comparability of analytical outcomes. Whereas existing methods may provide several alternatives for a given methodological decision point, the intention of this Organisation Environmental Footprint guidance is (wherever feasible) to identify a single requirement for each decision point to support more consistent, robust and reproducible Organisation Environmental Footprint studies. Thus, **comparability is given priority over flexibility**.

To the extent possible, this guidance document strives to align with existing or upcoming international methodological norms, including ISO 14069 (draft) and GHG Protocol Scope 3, as well as the Product Environmental Footprint Guide. Similarly, efforts have also been made to align as far as possible with the existing environmental management schemes (EMAS and ISO 14001). It should be noted, however, that in order to provide for multi-criteria environmental assessment at the organisational level using a life cycle approach, the OEF Guide necessarily goes beyond existing guidance documents in important respects.

This document is intended as a detailed, stand-alone guide to implementing the requirements for Organisation Environmental Footprint studies. The guide is not, however, intended to support comparative assertions (i.e. claims of overall superiority or equivalence of the environmental performance of one organisation compared to another). This will require the development of additional Organisation Environmental Footprint Sector Rules (OFSRs) in complement to the more general guidance in order to further increase methodological harmonization, specificity, relevance and reproducibility for a given sector.

Relationship to the Product Environmental Footprint Guide

Like the Product Environmental Footprint (PEF) method[3], the Organisation Environmental Footprint (OEF) method provides a life cycle approach to quantifying environmental performance. Whereas the PEF method is specific to individual goods or services, the Organisation EF method applies to organisational activities as a whole – in other words, to all activities associated with the goods and/or services the organisation provides from a supply chain perspective. Organisation and Product Environmental Footprinting should therefore be viewed as directly complementary activities, each undertaken in support of specific applications.

Calculating the Organisation Environmental Footprint does not require multiple, product-level analyses. Rather, the OEF is calculated using aggregate data representing the flows of resources and wastes that cross the defined organisational boundary. Once the OEF is calculated, however, it may be disaggregated to the product level using appropriate allocation keys. In theory, the sum of PEFs for an organisation should be equal to its OEF. The methodologies have been purposefully developed towards this end. Moreover, the OEF can help to identify areas of the organisation's product/service portfolio where environmental impacts are most significant and, hence, where detailed, individual product-level analyses may be desirable.

[3] http://ec.europa.eu/environment/eussd/product_footprint.htm

1. General Considerations for Organisation Environmental Footprint Studies

The Organisation Environmental Footprint (OEF) is a multi-criteria measure of the environmental performance of a goods/services providing organization from a life cycle perspective. This includes companies, public administrative entities, territories, and other bodies. This document provides guidance on how to calculate an Organisation Environmental Footprint, as well as how to create sector-specific methodological requirements for use in Organisation Environmental Footprint Sector Rules (OFSRs). Organisation Environmental Footprint Sector Rules (OFSRs) are a necessary extension of and complement to the more general guidance for Organisation Environmental Footprint studies provided in this document. As they are developed, OFSRs will play an important role in increasing the reproducibility, consistency, and relevance of Organisation Environmental Footprint studies. OFSRs will facilitate focusing on the most important parameters, thus also possibly reducing time, efforts, and costs for completing an OEF study.

Based on life cycle approach, the Organisation Environmental Footprint is a method for modeling the quantitative, physical environmental impacts of the flows of material/energy and resulting emissions and waste streams associated with organisational activities from a supply chain perspective. The life cycle approach to environmental management, and Life Cycle Thinking (LCT) in general, takes into consideration all relevant environmental interactions associated with a good, service, activity, or entity from a supply chain perspective in contrast to focusing on site level impacts only or on single environmental impacts in order to reduce the possibility of unintended burden shifting.

Achieving a model that provides for realistic representation of these physical flows and impacts requires that modeling parameters are defined, as far as possible, based on concrete, physical terms and relationships. The Organisation Environmental Footprint is not a financial accounting model, hence efforts have been made to minimize the need for using financial information (for example, in defining organisational boundaries), which may be poorly representative of the physical relationships pertinent to the systems modeled.

REQUIREMENT: An Organisation Environmental Footprint study shall be based on a life cycle approach.

How to Use this Guide

The Organisation Environmental Footprint guide provides the information necessary to conduct an OEF study. The material in the guide is presented in a sequential manner, in order of the methodological phases necessary to calculate an OEF. Each section begins with a general description of the methodological phase, along with an overview of necessary considerations and supporting examples. “Requirements” specify the methodological norms that must be satisfied in order to achieve an OEF-compliant study. These are positioned in text boxes with single solid line borders following the general description sections. “Tips” describe non-mandatory but recommended best practices. These are positioned in shaded text boxes, also with single solid line borders. Where additional requirements for creating OFSRs are specified, these are positioned in text boxes with double solid line borders at the end of each respective section.

1.1 Principles for Organisation Environmental Footprint Studies

To achieve the objective of consistent, robust and reproducible Organisation Environmental Footprint studies requires strict adherence to a core suite of analytical principles. These principles are intended to provide overarching guidance in the application of the Organisation Environmental Footprint methods. They should be considered with respect to each phase of Organisation Environmental Footprint studies, from the articulation of study goals and definition of the scope of the study, through data collection, environmental footprint impact assessment, reporting, and verification of study outcomes.

Accordingly, users of this guide shall observe the following principles in Organisation Environmental Footprint studies:

(1) Relevance

All methods and data collected and used for the purpose of quantifying the Organisation Environmental Footprint shall be as relevant to the study as possible.

(2) Completeness

Quantification of the Organisation Environmental Footprint shall include attention to all environmentally significant material/energy flows and other environmental interventions as required for adherence to the defined system boundaries, the data requirements, and the impact assessment methods employed.

(3) Consistency

Strict conformity with this guide shall be observed in all steps of the Organisation Environmental Footprint study so as to enhance internal consistency as well as comparability with similar analyses.

(4) Accuracy

All reasonable efforts shall be taken to reduce uncertainties both in modeling and reporting of results.

(5) Transparency

Organisation Environmental Footprint information shall be disclosed in such a way so as to provide intended users with the necessary basis for decision making, and for stakeholders to assess its robustness and reliability.

Principles for Organisation Environmental Footprint Sectorial Rules:

1. Relationship with the Organisation Environmental Footprint (OEF) guide

The methodological requirements set out for OFSRs shall apply to Organisation Environmental Footprint studies in addition to the requirements of the OEF guide. These more specific requirements take precedence over the more general requirements described in the OEF guide.

2. Involvement of selected interested parties

The process of developing Organisational Environmental Footprint Sectorial Rules (OFSRs) should be open and transparent and should include a consultation with selected interested parties. Reasonable efforts

should be made to achieve a consensus throughout the process (adapted from ISO 14020:2000, 4.9.1, Principle 8).

3. Striving for comparability

The results of OEFs that have been conducted in line with the OEF guide and the relevant OFSR document may be used to support the comparison of the environmental performance of organisations on a life cycle basis. Therefore, comparability of the results is critical. The information provided for this comparison shall be transparent in order to allow the user to understand the limitations of comparability inherent in the calculation result (adapted from ISO 14025).

2. Role of Organisation Environmental Footprint Sector Rules (OFSRs)

2.1 General

In additional to providing general guidance and requirements for OEF studies, this guide also specifies additional requirements for developing Organisation Environmental Footprint Sector Rules. The objective is to ensure that OFSRs are developed according to the OEF guide and that they provide the required further specifications to achieve increased reproducibility, consistency, relevance, focus and efficiency of OEF studies. OFSRs should aim to focus environmental footprint assessments on those aspects and parameters most pertinent to determining environmental performance for the sector considered. An OFSR can further specify requirements made in this OEF guide and can add new requirements where the more general OEF guide leaves several choices.

Key areas to be covered in OFSRs are identified and include, for example:

- Choice and description of system boundaries (Organisational boundaries and Organisation Environmental Footprint boundaries)
- Defining relevant/irrelevant environmental aspects;
- identifying environmentally significant versus insignificant processes to focus data gathering efforts;
- Description of the information to be included in the use and end-of-life phases, if included in the analysis;
- Choice of cut-off criteria;
- How to compile the Product/Service Portfolio , including key related reference flow(s)
- Choice of underlying data, indicating which data are to be directly collected (specific) and which are generic and providing guidance on possible data sources;
- Specific rules for solving multi-functionality of key processes/activities for the sector
- Review requirements
- Reporting requirements

The principle target audience for this additional guidance is the technical experts or practitioners in the public and private sectors tasked with developing OFSR documents.

2.2 Defining the sector that is subject to the OFSR

The sector shall be defined with reference to the characteristic sectorial Product/Service Portfolio using NACE codes (i.e. in line with Nomenclature générale des Activités Economiques dans les Communautés Européennes NACE Rev. 2). NACE is an acronym referring to the statistical classification of economic activities in Europe. One NACE code is assigned to each unit recorded in statistical business registers, according to its principal economic activity. The principal activity is the activity which contributes most to

the value added of the unit. The assignment of the NACE code is helped by: the explanatory notes of NACE, decisions taken by the NACE management committee, correspondence tables and reference to Classification of Product Activity (CPA). An activity as defined here "may consist of one simple process (for example weaving), but may also cover a whole range of sub‑processes, each mentioned in different categories of the classification (for example, the manufacturing of a car consists of specific activities such as casting, forging, welding, assembling, painting, etc.). If the production process is organised as an integrated series of elementary activities within the same statistical unit, the whole combination is regarded as one activity" (NACE Rev. 2 2008).

NACE consists of a hierarchical structure as follows (NACE Rev. 2 2008[4]):

1. a first level, comprising headings identified by an alphabetical code (sections)
2. a second level, comprising headings identified by a two-digit numerical code (divisions)
3. a third level, comprising headings identified by a three-digit numerical code (groups)
4. a fourth level, comprising headings identified by a four-digit numerical code (classes)

The sector should be defined such that it accommodates all relevant organisations in the sector. However, it must simultaneously be specific enough so as to facilitate the formulation of appropriately representative and prescriptive environmental footprint sector rules above and beyond those specified in the OEF guide. The OFSR is, therefore, defined primarily with reference to the activities characteristic of the sector, as represented in a typical Product/Service Portfolio.

To identify the set of activities by which organisations may be grouped under an OFSR, several criteria should be considered:

- The organisations should provide similar goods/services (e.g. road transport, electricity provision, retail sales)
- The relevant environmental impacts related to the activities of the organisations can be described by a similar set of environmental footprint impact categories, methods, and other indicators)
- The organisations should have similar organisational boundaries and source a sufficiently similar profile of product and service inputs

The sector for which the OFSR is to refer shall be defined using NACE codes.

[4] http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-RA-07-015

3. Summary of Organisation Environmental Footprint Requirements and Requirements for Developing OFSRs

Table 1. Summary of Organisation Environmental Footprint Requirements and Requirements for Developing OFSRs.

Chapter	Criteria	Organisation Environmental Footprint Requirement	Requirement for Developing Organisation Environmental Footprint Sectorial Rule
	General Approach	The Organisation Environmental Footprint shall be based on a life cycle approach.	
1	Principles	Users of this guide shall observe the following principles in conducting an Organisation Environmental Footprint study: • Relevance • Completeness • Consistency • Accuracy • Transparency	Principles for Organisation Environmental Footprint Sectorial Rules: 1. Relationship with the Organisation Environmental Footprint (OEF) guide The methodological requirements set out for OFSRs shall apply to Organisation Environmental Footprint studies in addition to the requirements of the OEF guide. These more specific requirements take precedence over the more general requirements described in the OEF guide. 2. Involvement of selected interested

			parties The process of developing Organisational Environmental Footprint Sectorial Rules (OFSRs) should be open and transparent and should include a consultation with selected interested parties. Reasonable efforts should be made to achieve a consensus throughout the process (adapted from ISO 14020:2000, 4.9.1, Principle 8). 3. Striving for comparability The results of OEFs that have been conducted in line with the OEF guide and the relevant OFSR document may be used to support the comparison of the environmental performance of organisations on a life cycle basis. Therefore, comparability of the results is critical. The information provided for this comparison shall be transparent in order to allow the user to understand the limitations of comparability inherent in the calculation result (adapted from ISO 14025).
2.2	Defining the Sector	NA	The sector for which the OFSR is to refer shall be defined using NACE codes.
4	Goal Definition	Goal definition for the Organisation Environmental Footprint study shall include: • Intended application(s) • Reasons for carrying out the study and decision context	The OFSR shall specify the review requirements for OFSR studies.

		• Target audience • Commissioner of the study • Review Procedure	
5	Scope Definition	Scope definition shall include: • Definition of the Organisation (unit of analysis) and the Product/Service Portfolio (suite and amount of goods/services marketed over the reporting interval) • System boundaries (organisational and Organisation Environmental Footprint boundaries) • Cut-off criteria • Environmental footprint impact categories • Assumptions/limitations	
5.2	Defining the Organisation	The Organisation (or clearly defined subset thereof subject to the Environmental Footprint study) shall be defined according to the following aspects: • The name of the organisation • The kinds of products/services the organisation produces (i.e. the sector) • Locations of operation (i.e. countries)	
5.3	Product/Service Portfolio	A Product/Service Portfolio shall be defined for the Organisation, which represents the sum of goods and services (or clearly defined subset thereof) marketed by the Organisation over the reporting interval (one year) in terms of "what" and "how much". For modeling product/service use and end-of-life scenarios, information on "how well", and "for how long" with respect to product/service performance shall also be provided. Any exclusion shall be explicitly justified. The quantitative input and output data collected in support of the analysis shall be calculated in relation to the specified	The OFSR shall further specify how the Product/Service Portfolio is defined, in particular with respect to "how well" and "for how long."

		Product/Service Portfolio.	
5.4	System Boundaries	System boundaries shall include both organisational boundaries and Organisation Environmental Footprint boundaries	
5.4	Organisational Boundaries	Organisational boundaries for calculating the Organisation Environmental Footprint shall encompass all of the facilities/activities that the organisation owns and/or operates (whether partially or in full) that contribute to producing the Product/Service Porfolio during the reporting interval.	The OFSR shall specify the characteristic processes, activities and facilities for the sector of concern to be included in the organisational boundaries.
5.4	Organisation Environmental Footprint Boundaries	The Organisation Environmental Footprint Boundaries shall be established in terms of direct and/or indirectly attributable activitities occurring along the supply chains associated with Organisation's Product/Service Portfolio. This shall include, at a minimum, site-level (direct) and upstream (indirect) activities. Explicit justification shall be provided if downstream (indirect) activities are excluded. All environmentally significant processes within the defined OEF boundaries shall be considered. To establish whether or not a certain process is environmentally significant, cut-off criteria shall be established and applied.	The OFSR shall specify: • which supply chain stages are to be included in the OEF study • which direct (gate-to-gate) and indirect (upstream and downstream) processes/activities are to be included in the OEF study • justifications for inclusions/exclusions
5.4	Offsets	Offsets shall not be included in the Organisation Environmental Footprint study. However, they may be reported separately as "additional environmental information."	

5.5	Environmental Footprint Impact Categories	Default Categories: • Climate change • Ozone depletion • Human toxicity, cancer effects • Human toxicity, non-cancer effects • Particulate matter/Respiratory inorganics • Ionising radiation, (human health) • Photochemical ozone formation • Acidification • Eutrophication, terrestrial • Eutrophication, aquatic • Ecotoxicity (aquatic, freshwater) • Land Transformation[5] • Resource depletion, water • Resource depletion, mineral, fossil and Renewable The specified impact assessment models shall be implemented.	
5.5	Identifying Relevant Environmental Footprint Impact Categories	For an Organisation Environmental Footprint study, all of the specified default environmental footprint impact categories and associated specified impact assessment models (see Table 2) shall be applied. Any exclusion shall be explicitly justified and their influence on the final results discussed. Such exclusions are subject to review. Justification shall be supported by documents derived from: • International consensus process • Independent external review • Multi-stakeholder process	The OFSR shall specify: • the mandatory environmental footprint impact categories that must be considered for the sector in question, as well as those that may be excluded • additional environmental information that is to be included in the OEF study. Additional environmental information may include: o Other relevant environmental impacts for the sector o Environmental indicators or

[5] Quantifies changes in soil organic matter associated with specific land use strategies.

		Additional relevant environmental indicators can be included as appropriate as “additional environmental information”, with all supporting methods clearly referenced/documented.	Product responsibility indicators (as per the Global Reporting Initiative (GRI)) o Core indicators from the EMAS regulation o Indicators that express the environmental information produced in the OEF using formats conducive to management for improved environmental performance as well as for improved communication in the sector For example, in addition to communication of absolute values for each impact category considered, this might include intensity-based metrics such as impacts per unit of product/service, employee, gross sales, or value-added, as appropriate to the sector of concern. o Total energy consumption by primary energy source, separately accounting for “renewable” energy use o Direct energy consumption by primary energy source, separately accounting for “renewable” energy use for facility gate o For gate-to–gate phases, Number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk o Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity

			value outside protected areas. o Total weight of waste by type and disposal method. o Weight of transported, imported, exported, or treated waste deemed hazardous under the terms of the Basel Convention Annex I, II, III, and VIII, and percentage of transported waste shipped internationally • Justifications for inclusions/exclusions
5.6	Cut-off Criterion	If cut-offs are applied, they shall be based on contributions to each environmental impact category as calculated during the screening phase. The threshold shall be 90% inclusiveness. Any cut-off shall be justified and its potential influence on final results assessed.	The OFSR shall specify more stringent cut-off rules for the OFSR, if appropriate for the sector considered. These may include: • gate-to-gate activities/processes • upstream or downstream phases • environmentally significant processes • key supply chain activities for the sector • key environmental footprint impact categories for the sector
6	Resource Use and Emissions Profile	The Resource Use and Emissions Profile shall be the documented input and output flows associated with all environmentally significant activities and processes within the defined Organisation Environmental Footprint boundaries. The following aspects shall be accounted for: For evaluation of directly attributable activities (i.e. within the defined organisational boundary): Use of materials, energy and emissions directly associated with provision of the Product/Service Portfolio, including	The OFSR shall further specify sources, quality and review requirements for the data used in an OEF study. The OFSR shall provide one or more templates for compiling the Resource Use and Emissions Profile, including specifications with respect to: • substance lists for included activities/processes

		• Site-level activities (materials and energy consumed for processing, manufacturing, etc.) • Capital equipment (linear depreciation) • Business travel (mode, vehicle type, distance) • Client and visitor transportation (mode, vehicle type, distance • Transportation from suppliers, where means of transport are owned and/or operated by the organisation (mode, vehicle type, distance, load) • Waste streams (composition, volume) • Other environmentally relevant site-specific activities In addition, for evaluation of indirectly attributable upstream activities: Use of materials, energy and emissions associated with products/services sourced from upstream of the organisational boundary in support of producing the Product/Service Portfolio, including • Extraction of raw materials • Agricultural activities • Land use and land use change • Manufacturing, production, and processing • Generation of electricity consumed by upstream activities • Disposal/treatment of waste generated by upstream activities • Transportation of materials and products between suppliers and from supplier when means of transport are not owned and/or operated by the organisation • Any other environmentally significant upstream	• units • nomenclature for elementary flows These may apply to one or more supply chain stages, processes, or activities, for the purpose of ensuring standardized data collection and reporting. The OFSR may specify more stringent data requirements for key upstream, gate-to-gate or downstream phases than those defined in the OEF guide. For modelling processes/activities within the defined organisational boundary (i.e. gate-to-gate phase), the OFSR shall also specify: • Included processes/activities • Specifications for compiling data for key processes, including averaging data across facilities • Any site-specific data required for reporting as “additional environmental information” • Data quality requirements The OFSR shall also specify: • The use phase and end-of-life scenarios

		processes In addition, for evaluation of indirectly attributable downstream activities: Use of materials, energy and emissions associated with • Transportation and distribution of sold products/services to the client, when means of transport are not owned and/or operated by the organisation • Use stage of the products/services • End of life of the products/services • Third-party waste treatment facilities. • Any other environmentally significant downstream processes	to be included in the study Transport scenarios to be included in the study
6	Temporary Storage, Delayed Emissions, and Delayed Credits	Credits associated with temporary storage or delayed emissions shall not be considered in the calculation of the Organisation Environmental Footprint for the default impact categories. This may be report as “additional environmental information.”	
6.4	Nomenclature	ILCD nomenclature and properties shall be used (Annex IV ensures correspondence with the ILCD nomenclature rules and properties). If nomenclature and properties for a given flow are not available in the ILCD, the practitioner shall create an appropriate nomenclature and document the flow properties.	
6.5	Screening Phase to Identify Environmentally Significant Processes	The organisation shall use a screening phase to identify the most environmentally significant processes or activities accounting for at least 70% of contributions to each environmental footprint impact category. All processes and activities to be considered in the Resource Use and Emissions Profile shall be included in the screening exercise. At least “fair	In place of the screening phase, the OFSR shall specify the environmentally significant processes that must be taken into account. The OFSR shall also specify for which processes specific data is required, and for which the use of generic data is either permissible or

		quality" data shall be used to identify the environmentally significant processes, as assessed via qualitative expert judgment. The selection process shall be documented and subject to review, as per the requirements of the intended application.	required.
6.6	Data Quality	For the most environmentally significant processes or activities, accounting for at least 70% of contributions to each impact category, both directly collected (specific) and generic data shall achieve at least an overall "good quality" level. A semi-quantitative assessment of data quality shall be performed and reported for these processes. For environmentally significant processes accounting for the subsequent 20% (i.e. from 70% to 90%) of contributions to environmental impacts, at least "fair quality" data shall be used, as assessed via qualitative expert judgment. Remaining data (used for approximation and filling identified gaps (beyond 90% contribution to environmental impacts)) shall be based on best available information.	
6.7	Specific Data Collection	Specific data must be obtained for all environmentally significant processes within the defined organisational boundary and for environmentally significant background processes where possible.	1. Specify for which processes specific data has to be collected. 2. Specify the requirements for directly collected data for each environmentally significant process. 3. Define the data collection range for the conditions listed below for each site: - Target stage(s) and the data collection coverage, - Location of data collection (domestically, internationally, representative factories, and so on), - Term of data collection (year, season,

			month, and so on), - When the location or term of data collection must be limited to a certain range, provide a reason and show that the collected data will serve as sufficient samples. Note: The basic rule is that the location of data collection is all target areas and the term of data collection is a year or more.
6.8	Generic Data Collection	Generic data shall be used only if data for a specific process are unavailable, not environmentally significant, or refer to a process outside of the defined organisational boundary. Generic data shall, as far as possible, fulfill the data quality requirements specified in this guidance document. Subject to data quality requirements, generic data should be preferentially sourced from the specified hierarchy of data sources.	The OFSR shall: • Specify where the use of generic data is permitted as an approximation for a substance for which specific data is not available) • Specify the level of required similarities between the actual substance and the generic substance Specify the combination of more than one generic data sets, if necessary
6.9	Data Gaps for Specific Data	Any data gaps for environmentally significant processes shall be filled using generic or extrapolated data[6]. Such processes shall not account for more than 10% of the overall contribution to each impact category considered based on the initial screening exercise.	The OFSR shall specify potential data gaps and provide detailed guidance for filling data gaps
6.9	Data Gaps for Generic Data	Any data gaps for relevant processes shall be filled using extrapolated data. Such processes shall not account for more than 10% of the overall contribution to each impact category considered based on the initial screening exercise.	
6.10	Handling Multi-functionality Problems	The Organisation Environmental Footprint multi-functionality decision hierarchy shall be applied for resolving all multi-	The OFSR shall further specify multi-functionality solutions for application within the defined

[6] Extrapolated Data – Refers to data from a given process that is used to represent a similar process for which data is not available, on the assumption that it is reasonably representative

		functionality problems at both process and facility-level. All choices made in this context shall be reported and justified with respect to the overarching goal of ensuring physically representative, environmentally relevant results. 1. Subdivision 2. Substitution (shall only be applied where a realistic, physically representative substitution scenario can be identified. Such scenarios shall be clearly documented and justified, and their implications for the final results discussed). o employing substitution of a specific (identical) product o employing substitution of a market-average mix representative of the product 3. Allocation based on a relevant, underlying physical relationship 4. Allocation based on some other relationship For substitution in recycling situations the equation described in Annex III shall be applied.	organisational boundaries and, where appropriate, for upstream and downstream phases. If feasible/appropriate, then OFSR may further provide specific factors to be used in the case of allocation solutions. All such multi-functionality solutions specified in the OFSR must be clearly justified with reference to the OEF multi-functionality solution hierarchy, using the template provided. Where sub-division is to be applied, the OFSR shall specify which processes are to be sub-divided and according to what principles. Where substitution is to be applied, the OFSR shall specify the substitution scenarios, including the specific or market-mix substitutes that are required. Where allocation by physical relationship is to be applied, the OFSR shall specify the relevant underlying physical relationships to be considered, and establish the relevant allocation factors. Where allocation by some other relationship is to be applied, the OFSR shall specify the relationship and establish the relevant allocation factors. For example, in the case of economic allocation, the OFSR shall specify the rules for determining the economic values of co-

			products. In the event that information is sourced from documents derived from PEF of PFCR studies, the multi-functionality solutions used in such studies shall be retained for the data sets of interest.
7	Environmental Footprint Impact Assessment	Environmental footprint impact assessment shall include: • Classification • Characterisation	
7.1.1	Classification	All inputs/outputs tabulated during the compilation of the Resource Use and Emissions Profile shall be assigned to the environmental footprint impact categories to which they contribute ("classification") using the provided classification data.	
7.1.2	Characterisation	All classified inputs/outputs in each environmental footprint impact category shall be assigned characterisation factors representing the contribution per unit input/output to the category, using the specified characterisation factors. Environmental footprint impact assessment results shall subsequently be calculated for each category by multiplying the amount of each input/output by its characterisation factor and summing contributions of all inputs/outputs within each category to a single measure expressed in terms of an appropriate reference unit.	
7.2.1	Normalisation (if applied)	Normalisation is not a required step for Organisation Environmental Footprint studies. If normalisation is applied, the normalised environmental footprint results shall be calculated using the provided normalisation factors (to be provided with final version). Other normalisation factors can be used in addition to those provided and the results be reported under "additional environmental information".	

		The organisation shall not aggregate the normalised results as this implicitly applies a weighting factor (i.e. one).	
7.2.2	Weighting (if applied)	Weighting is not a required step for Organisation Environmental Footprint studies. If weighting is applied, the environmental footprint results shall be multiplied by the weighting factors provided (to be provided with final version). Other weighting factors can be used in addition to those provided. Weighted results shall be reported as "additional environmental information, with all methods and assumption documented. Results of the environmental footprint impact assessment prior to weighting have to be reported alongside weighted results.	
8	Interpretation	Interpretation of the Organisation Environmental Footprint study shall include: • Identification of significant issues • Identification of uncertainties • Conclusions, recommendations including improvement potentials, and limitations	
8.2	Identification of Significant Issues	Significant methodological issues shall be evaluated using a combination of completeness and consistency checks as appropriate. Organisation Environmental Footprint results shall subsequently be evaluated to assess supply chain hotspots/weak points on input/output, process, and supply chain stage bases and to assess improvement potentials.	
8.3	Identification of Uncertainties	A qualitative description of uncertainties shall be provided.	
8.4	Conclusions, Recommendations, and Limitations	Conclusions, recommendations and limitations shall be described in accordance with the defined goals and scope of the Organisation Environmental Footprint study. Organisation	

		Environmental Footprint studies intended to support comparative assertions (i.e. claims about the environmental superiority or equivalence of organisations compared to other organisations) cannot be made on the basis of studies using only the OEF general guide but rather shall be based both on this OEF guidance and related Organisation Footprint Sector Rules (OFSRs).	
9	Organisation Environmental Footprint Reports	The study report shall include, at a minimum, an executive summary, technical summary, environmental footprint impact assessment, and any necessary supporting information.	The OFSR shall specify any additional reporting requirements for OEF studies, including: • Rules for establishing the base year and, if necessary, changing the base year and making recalculations with respect to the new base year • Required formats and units for reporting environmental footprint impact assessment results • Required formats and units for reporting additional absolute and intensity metrics, using indicators appropriate for sectorial reporting • Minimum sectorial reporting requirements • Rules for assertions regarding environmental performance in the sector
9.1	Benchmarking and Performance Tracking	Organisations applying the Organisation Environmental Footprint method should choose and justify a base year for the purpose of setting targets and tracking progress. The base year must be chosen so as to ensure comparable quality and quantity of data for all reporting intervals considered. The organisation should develop a base year environmental footprint recalculation policy that describes and defends the basis and context for any recalculations. Organic growth or decline shall not be used as a basis for base year recalculations. Organisations should report study outcomes, targets, and progress using both absolute and intensity-based performance	

		indicators. Where possible, organisations should report trends representing at least three years of data, including the base year, when such data is available. Organisations should define short-term and long-term targets for environmental footprint reductions for each criterion measured.	
10.2	Review Type	If intended for external use, the study shall be reviewed by an independent and qualified external reviewer (or review team).	The OFSR document shall define the process for stakeholder consultation and review. The OFSRs shall be reviewed by qualified reviewer(s) with a selected stakeholder panel. The review of OFSR documents shall demonstrate that OFSRs: • are developed in accordance with the Organisational Environmental Footprint guide • give a relevant description of the significant environmental aspects for the sector • that the specified requirements include all the mandatory elements as described in OEF guide • include a consultation procedure for relevant selected stakeholders
10.3	Reviewer Qualifications	A review of the Organisation Environmental Footprint study shall be conducted as per the requirements of the intended application. Unless otherwise specified, the minimum necessary score to qualify as a reviewer is 6 points, including at least one point for each of the three mandatory criteria (i.e. verification and audit practice, LCA methodology and practice, and technologies or other activities relevant to the Organisation Environmental Footprint study). Reviewers or panels of reviewers must provide a self-declaration of their qualifications, stating how many points they achieved for each	

		criterion.	

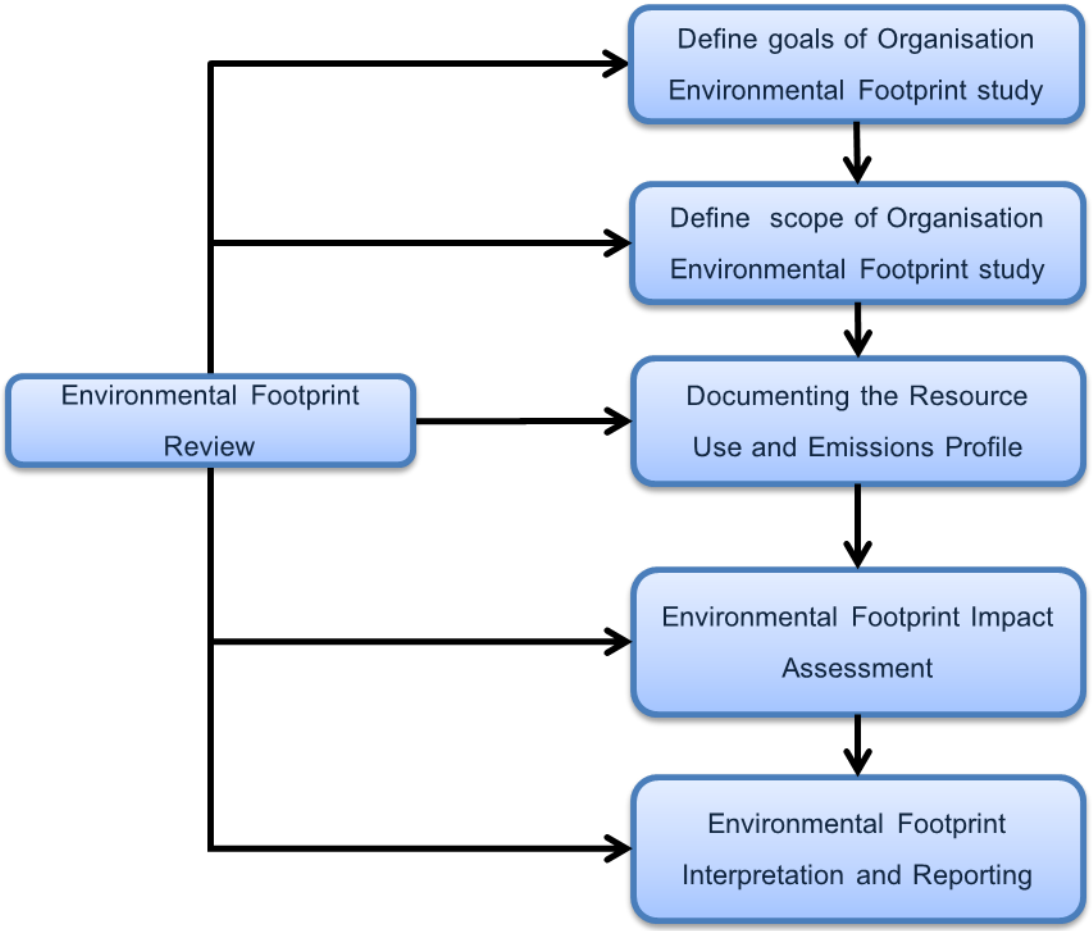


Figure 1: Process overview for Organisation Environmental Footprint Studies.

4. Defining the Goal(s) of the Organisation Environmental Footprint Study

Goal definition is the first step of an Organisation Environmental Footprint study, and sets the overall context for the study. The purpose of clearly articulating goals is to ensure that the analytical aims, methods, results and intended applications are optimally aligned, and that a shared vision is in place to guide participants in the study. The choice to use the Organisation Environmental Footprint guidance implies that some aspects of goal definition will be, a priori, decided. Nonetheless, taking the time to carefully consider and articulate goals will be an important step towards the success of the Organisation Environmental Footprint study.

An important element of the goal definition phase is to identify the intended applications of the study, and the associated necessary degree of analytical depth and rigor. In turn, this should be reflected in the defined study limitations (Scope definition phase). For analyses geared towards least-environmental cost sourcing, product design, benchmarking or reporting, fully quantitative studies in conformance with the analytical requirements specified in this general guide will be necessary. Combined approaches where only certain parts of the supply chain are subject to quantitative analysis and others to qualitative descriptions of potential environmental hotspots are also possible (for example, a quantitative cradle-to-gate analysis combined with qualitative descriptions of gate-to-grave environmental considerations or with quantitative analyses of the use and end of life stages for selected representative product/service types).

REQUIREMENT: Goal definition for the Organisation Environmental Footprint study shall include:

- Intended application(s)
- Reasons for carrying out the study and decision context
- Target audience
- Commissioner of the study
- Review Procedure

Example:

Aspects	Detail
Intended application(s):	Corporate sustainability reporting
Reasons for carrying out the study:	Demonstrate commitment to and practice of continuous improvement
Target audience	Customers
Review	Independent external reviewer, Mr. Y
Commissioner of the study:	G Company Ltd.

The OFSR shall specify the review requirements.

5. Defining the Scope of the Organisation Environmental Footprint Study

5.1 General

Defining the scope of the Organisation Environmental Footprint study refers to describing in detail the system to be evaluated along with the associated analytical specifications. Scope definition must be in alignment with the defined study goals and the requirements of the Organisation Environmental Footprint guidance. The Organisation (unit of analysis), the Product/Service Portfolio (the suite and amount of products and services marketed by the organisation over the reporting interval), system boundaries, cut-off rules, environmental footprint impact categories, and any assumptions/limitations for the Organisation Environmental Footprint study shall be identified and clearly described.

REQUIREMENT: Scope definition shall include:

- Defining the Organisation (unit of analysis) and Product/Service Portfolio (suite and amount of goods/services marketed over the reporting interval)
- System boundaries (organisational and Organisation Environmental Footprint boundaries)
- Cut-off criteria
- Environmental footprint impact categories
- Assumptions/Limitations

5.2 Defining the Organisation (unit of analysis)

Users of the Organisation Environmental Footprint guidance are required to define the Organisation (unit of analysis) and the Product/Service Portfolio (suite and amount of products and services marketed by the organisation over the reporting interval) for the Organisation Environmental Footprint study.

It is important to understand the relationship between these concepts, and the purpose they serve in the Organisation Environmental Footprint study.

The Organisation is the reference unit for the analysis, and (along with the Product/Service Portfolio), the basis for defining the organisational boundaries. It is parallel to the concept of “functional unit” in a traditional Life Cycle Assessment (LCA) or in a Product Environmental Footprint (PEF) study. In the most general sense, the overarching function of the organisation, for the purpose of calculating the Organisation Environmental Footprint, is the provision of goods and services over a specified reporting interval. The Organisation Environmental Footprint study is intended to provide a measure of the environmental

pressures related to the provision of goods and services by the organisation. Defining the Organisation with reference to the Product/Service Portfolio therefore facilitates direct representation of the organisations physical exchanges with the environment.

REQUIREMENT: The Organisation (or clearly defined subset therefore to be subject to the Environmental Footprint study) shall be defined according to the following aspects:

- The name of the organisation
- The kinds of products/services the organisation produces (i.e. the sector)
- Locations of operation (i.e. countries)

Example:

Organisation: Y Company Ltd.

Goods/Services Sector: garment manufacturer

Location: Paris, Berlin, Milan

5.3 Product/Service Portfolio

The Product/Service Portfolio refers to the sum and nature of products and services marketed by the organisation over the reporting interval. It constitutes the basis for completing the Resource Use and Emissions Profile for the organisation, which is the sum of input and output flows associated with the production of the organisation's Product/Service Portfolio as per the defined system boundaries for the study.

REQUIREMENT: A Product/Service Portfolio shall be defined for the Organisation, which represents the sum of goods and services (or clearly defined subset thereof) marketed by the organisation over the reporting interval (one year) in terms of "what" and "how much". For modeling product/service use and end-of-life scenarios, information on "how well", and "for how long" with respect to product/service performance shall also be provided. The quantitative input and output data collected in support of the analysis shall be calculated in relation to the specified Product/Service Portfolio.

Example:

Product/Service Portfolio:

(WHAT) T shirts (average for size S, M, L) made from polyester, pants (average for size S, M, L) made from polyester

(HOW MUCH) 40,000 T shirts, 20,000 pants

(HOW WELL) Wear one time per week and use washing machine at 30 degrees for cleaning once weekly

(HOW LONG) For 5 years each

(REPORTING INTERVAL) 2010

The OFSR shall further specify how the Product/Service Portfolio is defined, in particular with respect to "how well" and "for how long."

5.4 System Boundaries for Organisation Environmental Footprint Studies

Organisational activities are ultimately embedded in networks of social, financial and physical relationships. It is therefore necessary to establish boundaries for the Organisation Environmental Footprint study in order to formally delineate which of these relationships will be considered in calculating the environmental footprint, and which will be excluded. A key insight that has emerged from life-cycle based approaches to environmental accountancy is that resource use and emissions linked to processes upstream (i.e. goods and services purchased by the organisation) or downstream (i.e. linked to the distribution, storage, use, and end-of-life of the products/services the organisation provides) may be key determinants of the overall environmental profile of the organisation. Effective and efficient environmental management therefore requires attention to these upstream and downstream processes, and consideration of the extent to which they are or can be influenced by decision making at the organisational level.

Given the obviously important role that the choice of system boundaries will contribute to deciding the magnitude of the calculated Organisation Environmental Footprint, these must be established in a principled and consistent manner. The definition of boundaries also directly determines the utility of analytical outcomes for specific applications. For example, to generate analytical outcomes most suitable to informing environmental management of direct, site-level impacts, appropriate organisational boundaries are necessary. To inform management of broader, supply chain impacts, system boundaries that encompass upstream and/or downstream processes are required. An Organisation Environmental Footprint exercise that shows that the majority of environmental impacts occur upstream along the supply chain in association with specific processes provides the necessary basis for improvements along the supply chain. An analysis that suggests that downstream impacts are most important may point towards opportunities of redesigning products/services or changing the composition of the Product/Service Portfolio.

The system boundaries should be defined following general supply-chain logic, including all environmentally significant stages from raw material extraction through processing, distribution, the use stage and end-of-life treatment of the products/services produced by the organisation, as appropriate to the intended application of the study. If an Organisation Footprint Sector Rule (OFSR) is developed, the relevant processes will be further specified in the sector-specific requirements, including temporal, geographical, and technological specifications.

Two levels of system boundary definition are necessary for an Organisation Environmental Footprint study – organisational boundaries (in relation to the defined Organisation), and Organisation Environmental Footprint boundaries (that specify which aspects of the supply chain are included in the analysis).

REQUIREMENT: System boundaries shall include both organisational boundaries and Organisation Environmental Footprint boundaries

ORGANISATIONAL BOUNDARIES

In the interest of maximizing the physical representativeness of the Organisation Environmental Footprint model, it is most appropriate to prescribe an approach to defining organisational boundaries that is explicitly linked to the Product/Service Portfolio. For this reason, organisational boundaries for Organisation Environmental Footprint studies are defined so as to encompass all facilities and associated processes that are fully or partially owned and/or operated by the organisation and that directly contribute to the production of the Product/Service Portfolio. This corresponds to the "control" approach in that, in theory, the organisation should be able to leverage direct access to specific data for activities in which they have an operational or financial stake and also to influence environmental management decisions for the facilities of concern based on the results of the Organisation Environmental Footprint study.

Since some jointly owned/operated facilities may contribute to the production both of the defined Product/Service Portfolio of the organisation as well as to the Product/Service Portfolios of other organisations, it may be necessary to allocate inputs and outputs accordingly (see 4.10 Handling Multifunctional Processes).

REQUIREMENT: Organisational boundaries for calculating the Organisation Environmental Footprint shall encompass all of the facilities/activities that the organisation owns and/or operates (whether partially or in full) that contribute to producing the Product/Service Portfolio.

Example:

Facility	Status	Directly contributes to Product/Service Portfolio?	Included in System Boundary
Textile plant	Operated/not owned	Yes	Yes
Textile plant	Part owned/ operated	Yes	Yes
Factory (sewing)	Owned/ operated	Yes	Yes
Bottle factory	Minority share	No	No

The OFSR shall specify:

- the characteristic processes, activities and facilities for the sector of concern to be included in the organisational boundaries

ORGANISATION ENVIRONMENTAL FOOTPRINT BOUNDARIES

Depending on the intended application, Organisation Environmental Footprint studies may require system boundaries that are broader than the organisational boundaries defined for the Organisation as a unit of analysis. Towards this end, it useful to define Organisation Environmental Footprint boundaries in terms of direct and indirect activities and associated impacts. Here, "direct" refers to activities and impacts linked to processes within the defined organisational boundaries. Indirect activities and impacts are those that occur upstream or downstream along the supply chains linked to organisational activities, but that fall outside of the defined organisational boundaries.

REQUIREMENT: The Organisation Environmental Footprint Boundaries shall be established in terms of direct and/or indirectly attributable activitities occurring along the supply chains associated with Organisation's Product/Service Portfolio. This shall include, at a minimum, site-level (direct) and upstream (indirect) activities. Explicit justification shall be provided if downstream (indirect) activities are excluded. All environmentally significant processes within the defined OEF boundaries shall be considered. To establish whether or not a certain process is environmentally significant, cut-off criteria shall be established and applied.

Tip: The degree of robustness with which the full supply chain Organisation Environmental Footprint can be assessed for an organisation will depend strongly on the nature and variety of goods/services the organisation produces.

If the organisation produces intermediate goods/services where establishing robust end-use scenarios is not feasible, modeling only direct and indirect upstream impacts may be preferred. The organisation might also consider modeling the use and end-of-life stages for only a small, representative subset of goods/services.

In all cases, system boundaries should be established and justified in relation to the defined goals and intended applications of the study.

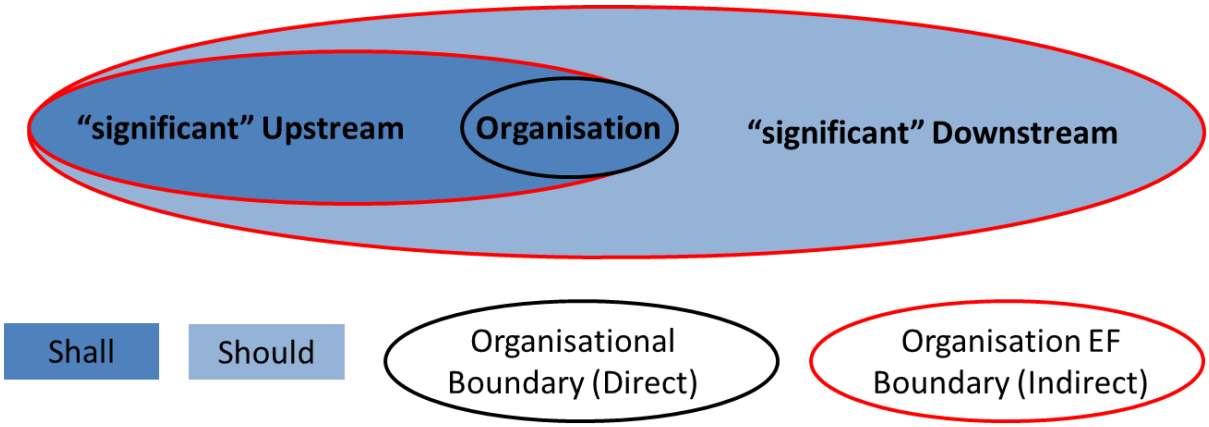


Figure 2: Organisational and Organisation Environmental Footprint boundaries. Note: Any exclusions (e.g. downstream activities) must be explicitly justified within the context of the study and the intended application.

The OFSR shall specify:

- which supply chain stages are to be included in the OEF study
- which direct (gate-to-gate) and indirect (upstream and downstream) processes/activities are to be included in the OEF study
- justifications for inclusions/exclusions

System boundary diagram

A system boundary diagram is a schematic representation of the analyzed system. It details which parts of the Organisation supply chain are included or excluded from the analysis. A system boundary diagram can be a useful tool in defining the system boundary and organizing subsequent data collection activities.

Tip: It is not mandatory to prepare system boundary diagram, but it is recommended. The system boundary diagram will help the organisation to define and structure the analysis.

How to deal with offsets in an OEF

The term "offset" is frequently used with reference to third-party greenhouse gas mitigation activities. Offsets are discrete GHG reductions used to compensate for (i.e., offset) GHG emissions elsewhere, for example to meet a voluntary or mandatory GHG target or cap. Offsets are calculated relative to a baseline that represents a hypothetical scenario for what emissions would have been in the absence of the mitigation project that generates the offsets. To avoid double counting, the reduction giving rise to the offset must occur at sources or sinks not included in the target or cap for which it is used.

REQUIREMENT: Offsets shall not be included in the Organisation Environmental Footprint study. However, they may be reported separately as "additional environmental information."

5.5 Selecting Environmental Footprint Impact Categories and Assessment Methods

Environmental footprint impact categories refer to specific categories of environmental impacts considered in an Organisation Environmental Footprint study. These are generally related to resource use (for example, fossil fuels and mineral ores) or emissions of environmentally problematic substances, such as greenhouse gases or toxic chemicals. Environmental footprint impact assessment methods use models for quantifying the causal relationships between the material/energy inputs and emissions associated with Organisational activities (tabulated in the Resource Use and Emissions Profile) and each environmental footprint impact category considered. Each impact category hence has an associated, stand-alone environmental footprint impact assessment method.

The purpose of environmental footprint impact assessment is to group and aggregate the collected inventory data (Resource Use and Emissions Profile) according to the respective contributions to each impact category. This subsequently provides the necessary basis for interpretation of the environmental footprint results relative to the goals of the footprint study (for example, identification of supply chain "hot spots" and options for improvement). The selection of environmental footprint impact categories shall therefore be comprehensive in the sense that they cover all relevant environmental issues related to the activities of the organisation of interest. This OEF guide provides the following default list of environmental impact categories and related assessment methods to be used n OEF studies (Table 2).

Table 2: Default environmental footprint impact categories and impact assessment models for Organisation Environmental Footprint studies.

Environmental Footprint Impact Category	Impact Assessment Model	Source
Climate Change	Bern model - Global Warming Potentials (GWP) over a 100 year time horizon.	Intergovernmental Panel on Climate Change, 2007
Ozone Depletion (OD)	EDIP model based on the ODPs of the World Meteorological Organisation (WMO)	WMO 1999
Ecotoxicity	USEtox model	Rosenbaum et al, 2008
Human Toxicity - cancer effects	USEtox model	Rosenbaum et al, 2008
Human Toxicity – non-cancer effects	USEtox model	Rosenbaum et al, 2008
Particulate Matter/Respiratory Inorganics	RiskPoll model	Rabl and Spadaro, 2004
Ionising Radiation – human health effects	Human Health effect model	Dreicer et al. 1995
Photochemical Ozone Formation	LOTOS-EUROS model	Van Zelm et al, 2008 as applied in ReCiPe
Acidification	Accumulated Exceedance model	Seppälä et al.,2006, Posch et al, 2008
Eutrophication – terrestrial	Accumulated Exceedance model	Seppälä et al.,2006, Posch et al, 2008
Eutrophication – aquatic	EUTREND model	Struijs et al, 2009 as implemented in ReCiPe
Resource Depletion – water	Swiss Ecoscarcity model	Frischknecht et al, 2008
Resource Depletion – mineral,	CML2002 model	Van Oers et al 2002

fossil		
Land Transformation	Soil Organic Matter (SOM) model	Milà i Canals et al, 2007

To implement these methods, users of this guidance document shall apply the provided classification and characterisation data (WEBLINK TO BE PROVIDED) (see section 5.1). For further information on specific impact assessment categories and methods, please refer to the ILCD Handbook: Recommendations based on existing environmental impact assessment models and factors for Life Cycle Assessment in the European context[7].

Depending on the nature of Organisation activities and the intended applications of the Organisation Environmental Footprint study, users of this methodology guide may elect to narrow the suite of environmental impacts considered. However, exclusion of any of the default impact categories must be sufficiently justified, using the template provided. Such justification may be supported by documents derived from the following processes, as relevant within the context of the specific OEF:

- International consensus process
- Independent external review
- Multi stakeholder process

for example:

- previous, detailed OEF and PEF studies of similar systems
- EMAS sectoral reference documents (if existing for the sector of concern)
- Life cycle based macro level monitoring indicators on resources, products and wastes for the EU-27
- Organisation environmental reporting rules from other initiatives/ schemes
- Environmental Impact of Products (EIPRO) and Environmental Improvement of Products (IMPRO) studies for products/services provided by the organisation
- Environmental Key Performance Indicators for sectors, as reported by DEFRA (http://archive.defra.gov.uk/environment/business/reporting/pdf/envkpi-guidelines.pdf)

Any exclusion of default impact categories must be explicitly documented and justified in the Organisation Environmental Footprint report.

[7] http://lct.jrc.ec.europa.eu/assessment/publications

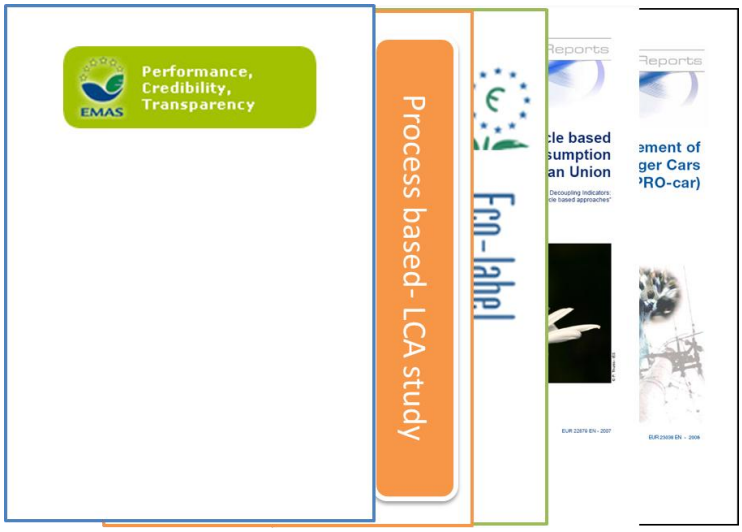


Figure 3: Example sources of information for selection of relevant environmental footprint impact categories

Example: Justification for exclusion of environmental footprint impact categories

Impact Categories Excluded	Justification
Particulate Matter/Respiratory Inorganics	Expert reviewer confirms that there are no significant Particulate Matter/Respiratory Inorganics impacts
Ionizing Radiation	Previous sectorial studies (references) indicate no significant ionizing radiation

REQUIREMENT: For an Organisation Environmental Footprint study, all of the specified default environmental footprint impact categories and associated specified impact assessment models (see Table 2) shall be applied. Any exclusion shall be explicitly justified and their influence on the final results discussed. Such exclusions are subject to review.

Such justification shall be supported by documents derived from the following processes, as relevant within the context of the specific OEF:

- International consensus process
- Independent external review
- Multi-stakeholder process

Additional relevant environmental indicators can be included as appropriate as “additional environmental information”, with all supporting methods clearly referenced/documented.

It is useful to further distinguish between "mid-point" and "end-point" environmental footprint impact assessment methods. The basis for the calculation of impact indicators using mid-point assessment methods is earlier in the cause-effect chain (for example, global warming potential reflect relative contributions to cumulative radiative forcing), whereas end-point assessment methods are based on impacts (for example, biodiversity loss due to e.g. climate change).

Both mid-point and end-point impact assessment methods are available for a variety of environmental impacts. Mid-point methods are generally better established (see ILCD …). They are hence preferred for Organisation Environmental Footprint studies. For example, impacts on biodiversity (end-point) are not calculated as such for Organisation Environmental Footprint studies, but are represented by indicators at mid-points for impact categories that negatively affect biodiversity, predominantly eco-toxicity, eutrophication, acidification, land use, climate change, and ozone depletion. Many pressures on biodiversity are hence well represented in the environmental footprint, even though a direct measure of biodiversity loss is not explicitly accommodated.

Additional Environmental Information

Even where widely accepted life cycle-based environmental impact assessment methods do not exist, however, it is important to consider as many relevant environmental impacts as is feasible – for example, biodiversity impacts that may occur in association with a specific site or activity. This may require the application of additional environmental impact assessment methods beyond the default list provided in this guidance document, or even additional qualitative descriptions where impacts cannot be linked to the Organisation activities in a quantitative manner. Such additional methods should be viewed as complementary to the default suite used for Organisation Environmental Footprint studies. For example, a variety of developing initiatives and schemes (such as the Global Reporting Initiative) provide models for organisations to report qualitatively on their biodiversity impacts. Any such additions must be supported by adequate documentation and review, using the template provided.

Additional environmental information may include:

- Other relevant environmental impacts for the sector
- Environmental indicators or product responsibility indicators (as per the Global Reporting Initiative (GRI))
- Core indicators from the EMAS regulation
- Indicators that express the environmental information produced in the OEF using formats conducive to management for improved environmental performance as well as for improved communication in the sector. For example, in addition to communication of absolute values for each impact category considered, this might include intensity-based metrics such as impacts per unit of product/service, employee, gross sales, or value-added, as appropriate to the sector of concern
- Total energy consumption by primary energy source, separately accounting for "renewable" energy use
- Direct energy consumption by primary energy source, separately accounting for "renewable" energy use for facility gate
- For gate-to–gate phases, Number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk

- Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas
- Total weight of waste by type and disposal method
- Weight of transported, imported, exported, or treated waste deemed hazardous under the terms of the Basel Convention Annex I, II, III, and VIII, and percentage of transported waste shipped internationally
- Information from environmental impact assessments (EIA) and chemical risk assessments

Such additional information shall be reported separately from the life-cycle based OEF results, with all methods and assumptions clearly documented.

To identify relevant/irrelevant environmental footprint impact categories and/or methods, including additional environmental information, the following form shall be used.

Source of information	*Source I: Ecolabel of …*	*Source II: LCA of.. .*	*Source III: …*
Environmental indicators, impact categories and methods covered in this source of information (please provide a comprehensive list)			
Climate Change			
Ozone Depletion			
Ecotoxicity – aquatic, fresh water			
Human Toxicity - cancer effects			
Human Toxicity – non-cancer effects			
Particulate Matter/Respiratory Inorganics			
Ionising Radiation – human health effects			
Photochemical Ozone Formation			
Acidification			
Eutrophication – terrestrial			
Eutrophication – aquatic			
Resource Depletion – water			
Resource Depletion – mineral, fossil and renewable			
Land transformation			
…..			
Additional indicators, impact categories and methods beyond the OEF guide (for each source)			
Exclusion/ Deviations to the default list of impact categories provided in	**Justification for change to the default**		

the OEF guide	
1	
2	
…	
Additional environmental indicator(s), impact categories or methods	**Justification for additional environmental indicator**
1	
2	
…	
Selected Environmental indicators, impact categories and methods for OEF according to this OFSR	1. 2. 3. 4.
Analysed by (Name, and date)	

The OFSR shall specify:

- the mandatory environmental footprint impact categories that must be considered for the sector in question, as well as those that may be excluded
- additional environmental information that is to be included in the OEF study. Additional environmental information may include:
    - Other relevant environmental impacts for the sector
    - Environmental indicators or Product responsibility indicators (as per the Global Reporting Initiative (GRI))
    - Core indicators from the EMAS regulation
    - Indicators that express the environmental information produced in the OEF using formats conducive to management for improved environmental performance as well as for improved communication in the sector. For example, in addition to communication of absolute values for each impact category considered, this might include intensity-based metrics such as impacts per unit of product/service, employee, gross sales, or value-added, as appropriate to the sector of concern.
    - Total energy consumption by primary energy source, separately accounting for "renewable" energy use
    - Direct energy consumption by primary energy source, separately accounting for "renewable" energy use for facility gate
    - For gate-to–gate phases, Number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk
    - Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas.
    - Total weight of waste by type and disposal method.
    - Weight of transported, imported, exported, or treated waste deemed hazardous under the terms of the Basel Convention Annex I, II, III, and VIII, and percentage of transported waste shipped internationally
    - Information from environmental impact assessments (EIA) and chemical risk assessments
- justifications for inclusions/exclusions

5.6 Cut-off Criterion

In principle, all processes and flows that are attributable to the analyzed system within the defined system boundaries are to be considered in the Organisation Environmental Footprint study. However, not all these processes and flows may be environmentally significant. Cut-off criteria serve to establish thresholds for inclusion of environmentally significant processes and flows, in the interest of balancing returns on effort and analytical robustness.

Neither the Organisation nor Product Environmental Footprint methods provide for systematically excluding specific classes of activities – for example, employee commuting, business travel, or capital goods. Rather, all activities should be assessed for environmental significance in order to support inclusion or exclusion from the analysis. The cut-off criterion to be applied in Organisation Environmental Footprint studies is that modeled flows must account for at least 90% of the overall contributions to each of the environmental impact categories considered.

REQUIREMENT: If cut-offs are applied, they should be based on contributions to each environmental impact category. The threshold shall be 90% inclusiveness. Any cut-offs must be justified and their potential influence on final results assessed.

TIP: identify the 90% cut-off level by using generic data (screening phase) to estimate the overall environmental impact of the Organisation for each impact category. See more details on identifying relevant processes in chapter 6.5

The OFSR shall specify more stringent cut-off rules for the OFSR, if appropriate for the sector considered, as well as identify/justify specific activities/processes that may be excluded. These may include:

- gate-to-gate activities/processes
- upstream or downstream phases
- environmentally significant processes
- key supply chain activities for the sector
- key environmental footprint impact categories for the sector

6. Compiling and Recording the Resource Use and Emissions Profile

6.1 General

An inventory (profile) of all environmentally significant material/energy resource inputs/outputs and emissions into air, water and soil shall be compiled as a basis for modeling the Organisation Environmental Footprint. This is called the Resource Use and Emissions Profile, and is compiled in terms of the sum of goods/services represented by the defined Product/Service Portfolio. At the organisational level, this includes all inputs and outputs for owned and/or managed processes that contribute to the production of the Product/Service Portfolio within the organisational boundary. At the analytical level, if upstream and downstream processes/flows are included in the defined Organisation Environmental Footprint boundaries, this includes all environmentally significant processes/flows linked to the production and or use and end-of-life stages of the Product/Service Portfolio.

Ideally, the model of the Organisation activities of interest would be constructed using facility or product/service specific data (i.e. modeling the exact life cycle depicting the supply-chain, use, and end-of-life phases as appropriate). In practice, and as a general rule, for processes within the defined organisational boundary, directly collected, facility-specific inventory data should be used. For processes outside of the organisational boundary, for which direct data access is not possible, generic data will typically be used. However, it is good practice to attempt to access directly collected data from suppliers when possible, in particular for environmentally significant processes. Generic data is data sourced from third-party life cycle inventory databases, government or industry association reports, statistical databases, peer-reviewed literature, or other sources. It is used when specific data is not available. All such data shall satisfy the quality requirements specified in the Organisation Environmental Footprint guidance document.

Documenting the data collection process is useful for improving the data quality over time, preparing for assurance, and revising future Organisation inventories to reflect changes in Organisation activities. To ensure that all of the relevant information is documented, it may be helpful to establish a data management plan early in the inventory process (see Annex II).

6.2 Data management plan

A data management plan is not required in the context of the OEF; however, it may be a valuable tool for managing data and for tracking the process of compiling the Resource Use and Emissions Profile.

The data management plan can include:

- A description of data collection procedures
    - processes/activities within the defined organisational boundaries
    - activities/processes outside (upstream or downstream) of the defined organisational boundaries – specific, average, or generic data?
- Data sources
- Calculation methodologies
- Data transmission, storage and backup procedures
- Quality control and review procedures for data collection, input and handling activities, data documentation and emissions calculations.
-

For additional guidance on possible approaches to formulating a data management plan, see Annex II.

6.3 Sources of Resource Use and Emissions Profile Data

For evaluation of directly attributable activities (i.e. within the defined organisational boundary):

Use of materials, energy and emissions directly associated with provision of the Product/Service Portfolio, including:

- Site-level activities (materials and energy consumed for processing, manufacturing, etc.)
- Capital equipment (linear depreciation)
- Business travel (mode, vehicle type, distance)
- Client and visitor transportation (mode, vehicle type, distance)
- Transportation from suppliers, where means of transport are owned and/or operated by the organisation (mode, vehicle type, distance, load)
- Waste streams (composition, volume)
- Other environmentally relevant site-specific activities

In addition, for evaluation of indirectly attributable upstream activities, use of materials, energy and emissions associated with products/services sourced from upstream of the organisational boundary in support of producing the Product/Service Portfolio

- Extraction of raw materials
- Agricultural activities
- Land use and land use change
- Manufacturing, production, and processing
- Generation of electricity consumed by upstream activities
- Disposal/treatment of waste generated by upstream activities
- Transportation of materials and products between suppliers and from suppliers where means of transport are not owned and/or operated by the organisation
- Any other environmentally significant upstream processes

In addition, for evaluation of indirectly attributable downstream activities:

Use of materials, energy and emissions associated with

- Transportation & distribution of sold products/services to the client, where means of transport are not owned and/or operated by the organisation
- Use stage of the products/services
- End of life of the products/services
- Third-party waste treatment facilities.
- Any other environmentally significant downstream processes

ADDITIONAL RESOURCE USE AND EMISSIONS PROFILE REQUIREMENTS

Accounting for Electricity Use
For electricity from the grid consumed upstream or within the defined organisational boundary, country-specific consumption mix data shall be used. For electricity consumed during the use phase of

products/services, the energy mix shall reflect ratios of sales between countries. Where such data are not available, the average EU consumption mix shall be used.

Accounting for Renewable Electricity Generation
Some organisations may produce electricity from renewable sources in excess of the amount consumed. If excess renewable energy produced within the defined organisational boundary is sold, it may only be credited to the organisation if the credit has not been taken in other related schemes. Documentation is required to explain whether or not the credit is considered in the calculation. Credits shall be calculated with respect to the average, country-level consumption mix.

Accounting for temporary (carbon) storage and delayed emissions
Credits associated with temporary (carbon) storage or delayed emissions shall not be considered in the calculation of the Organisation Environmental Footprint for the default impact categories. However, this may be reported as "additional environmental information." For more information, please see in the International Reference Life Cycle Data System Handbook: General Guide chapter 7.4.3.7.3[8].

Additional considerations for documenting greenhouse gas emissions and removals

Fossil and biogenic emissions: removals and emissions shall be reported separately for both fossil and biogenic sources.

Land Use Change (impact for climate change): greenhouse gas emissions from land use change shall be allocated to products/services for 20 years after the land use change occurs using the IPCC default values table. For details, see Annex I.

Indirect Land Use Change: shall not be included for the time being, as no accepted methodology is currently available.

Modeling Transport Scenarios

For modelling transport across the life cycle, the following parameters should be taken into account:

Transport type: The type of transport e.g. (by land (truck, rail, pipe), by water (boat, ferry, barge), or air (airplane)) should be taken into account.

Vehicle type & fuel consumption: The type of vehicle should be taken into account by transport type, as well as the fuel consumption when fully loaded and empty. An adjustment has to be applied to the consumption of a fully-loaded vehicle according to the loading rate (example see below).

Loading rate: Environmental impacts are directly linked to the actual loading rate, therefore the loading rate should be considered if possible.

Number of empty returns: It is essential to take into account the number of empty returns, i.e. the ratio of the distance travelled to collect the next load after unloading the considered product to the distance travelled to transport the product. The kilometres travelled by the empty vehicle should also be allocated to the considered product. Specific values must be developed by country and by type of transported product.

[8] http://lct.jrc.ec.europa.eu/assessment/publications

Transport distance: Transport distances must be documented. For the core module, average transport distances should be applied.

Allocation of impacts from transport: Where multiple goods are transported, it may be necessary to allocate a share of transportation stage impacts to the product of concern based on the load-limiting factor. The following requirements apply:[9]

- Goods transport: time or distance AND mass or volume (or in specific cases: pieces/pallets) of the transported good

  a) If mass is the load-limiting factor (this is the case when transporting products with a high density: the maximum authorised weight is reached before the vehicle has reached its maximum physical load: at 100% of its volume), then allocation should be based on the mass of transported products

  b) If the truck is transporting goods with a low density (in this case, the truck is loaded at 100% of the volume but it does not reach the authorised maximum weight), then allocation should be based on the volume of transported products.

  c) The allocation may be based on number of pallets, when all transported products are stored on pallets.

- Personal transport: time or distance
- Staff business travel: time, distance or costs

Fuel production: Fuel production should be taken into account. Default values for fuel production can be found e.g. in the European Reference Life Cycle Database (ELCD).

Infrastructure: Transport infrastructure, in particular for road, rail and boat transport, should be taken into account if the transport steps play an environmentally significant role.

Modelling Use and End-of-Life Scenarios

If downstream phases are to be included in the OEF, then use profiles (i.e. the related scenarios and assumed service life) must be specified for representative products/services for the sector. These should take into account published technical information, including:

- Published international standards that specify guidance and requirements for development of scenarios and service life for the use stage for the product/service being assessed
- Published national guidelines that specify guidance for development of scenarios and service life for the use stage for the product/service being assessed
- Published industry guidelines that specify guidance for development of scenarios and service life for the use stage for the product/service being assessed
- Market surveys or other market data

[9] For more information related to the consideration of transport related aspects, also see the International Reference Life Cycle Data System (ILCD) Handbook: General Guide for Life Cycle Assessment – detailed guidance, chapter 7.9.3

Definition of the use profile should also take into account use/consumption patterns, location, time (day/night, summer/winter, week/weekend), and assumed service life for the use stage of products. The use scenario also needs to reflect whether or not the use of analysed products might lead to changes in the systems that they are used in, e.g. energy using products might affect the energy needed for heating/cooling in a building or the weight of a car battery might affect the fuel consumption of the car. If such interdependencies exist, they need to be checked for relevance (change of environmental profile), and if relevant be explicitly included.

All relevant assumptions for the use stage shall be documented.

REQUIREMENT: The Resource Use and Emissions Profile shall be the documented input and output flows associated with all environmentally significant activities and processes within the defined Organisation Environmental Footprint boundaries.

REQUIREMENT: Credits associated with temporary storage or delayed emissions shall not be considered in the calculation of the Organisation Environmental Footprint for the default impact categories. This may be reported as “additional environmental information.”

The OFSR shall further specify sources, quality and review requirements for the data used in an OEF study.

The OFSR shall provide one or more templates for compiling the Resource Use and Emissions Profile, including specifications with respect to:

- substance lists for included activities/processes
- units
- nomenclature for elementary flows

These may apply to one or more supply chain stages, processes, or activities, for the purpose of ensuring standardized data collection and reporting. The OFSR may specify more stringent data requirements for key upstream, gate-to-gate or downstream phases than those defined in the OEF guide.

For modelling processes/activities within the defined organisational boundary (i.e. gate-to-gate phase), the OFSR shall also specify:

- Included processes/activities
- Specifications for compiling data for key processes, including averaging data across facilities
- Any site-specific data required for reporting as “additional environmental information”
- Data quality requirements

The OFSR shall also specify:

- The use phase and end-of-life scenarios to be included in the study
- Transport scenarios to be included in the study

6.4 Nomenclature for the Resource Use and Emissions Profile

Annex IV provides guidance on nomenclature.

REQUIREMENT: ILCD nomenclature and properties[10] shall be used (Annex IV ensures correspondence with the ILCD nomenclature rules and properties). If nomenclature and properties for a given flow are not available in the ILCD, the practitioner shall create an appropriate nomenclature and document the flow properties.

6.5 Screening Phase to Identify Environmentally Significant Processes

An initial "screening-level" Resource Use and Emissions Profile and Organisation Environmental Footprint Impact Assessment shall be undertaken in order to identify the most environmentally significant processes within the defined system boundaries. In turn, this screening study can help focus data collection activities and data quality priorities for completing the Resource Use and Emissions Profile. The screening phase informs application of cut-off criteria.

The kinds of information appropriate for use in the screening phase will depend on the defined goals/limitations and intended applications of the study. For all supply chain stages where quantitative Environmental Footprint impact assessment is intended, the screening-level Resource Use and Emissions Profile must be constructed using generic data of at least "fair quality", and environmental footprint impact assessment methods applied in order to identify environmentally significant processes. All processes and activities to be considered in the Resource Use and Emissions Profile (see 6.1) shall be included in the screening exercise.

For supply chain stages where quantitative Environmental Footprint impact assessment is not intended (can be for example the use stage of sold products in a cradle to gate OEF) , the screening phase will require referring to existing literature and other sources in order to develop qualitative descriptions of potentially environmentally significant processes. In such instances, the screening stage will represent the extent of the analysis for these supply chain stages. Any exclusions of supply chain stages must be explicitly justified, and their influence on the final results discussed.

In developing qualitative descriptions of potential environmentally significant processes in the supply chain, the following information sources should be considered, in order of preference and if relevant within the context of the specific OEF:

- Organisation Environmental Footprint and Organisation Environmental Footprint Sectorial Rules-based studies for similar organisations

[10] ILCD Handbook – Nomenclature and other conventions. Available online at http://lct.jrc.ec.europa.eu/assessment/publications

- Product Environment Footprint and Product Environmental Footprint Category Rule-based studies for key products/services provided by the organisations;
- Previous, detailed studies of similar organisations;
- EMAS sectoral reference documents, where these exist for the sector of concern;
- Organisation environmental reporting rules from other initiatives/ schemes;
- Environmental Impact of Products (EIPRO) and Environmental Improvement of Products (IMPRO) studies for products/services provided by the organisation;
- Environmental Key Performance Indicators for sectors, as reported by DEFRA (http://archive.defra.gov.uk/environment/business/reporting/pdf/envkpi-guidelines.pdf);
- Other peer-reviewed literature;

Such qualitative descriptions of potential supply chain impacts may be included in the Environmental Footprint report as "additional environmental information", with all information sources documented. They are not considered to be part of the Environmental Footprint impact assessment.

REQUIREMENT: The organisation shall use a screening step to identify the most environmentally significant processes or activities accounting for at least 70% of contributions to each environmental footprint impact category. All processes and activities to be considered in the Resource Use and Emissions Profile shall be included in the screening exercise. At least "fair quality" data shall be used to identify the environmentally significant processes, as assessed via qualitative expert judgment. The selection process shall be documented and subject to review, as per the requirements of the intended application.

In place of the screening exercise, the OFSR shall specify the environmentally significant processes that must be taken into account. The OFSR shall also specify for which processes specific data is required, and for which the use of generic data is either permissible or required.

6.6 Data quality requirements

Data quality indicators address how well the data fits the given process/activity in the Resource Use and Emissions Profile. When identifying collected (specific or generic) data for use in an Organisation Environmental Footprint study, data quality indicators shall be applied. Five data quality criteria are adopted for Organisation Environmental Footprint studies.

Table 1: Data quality criteria

Data quality	• Technological representativeness • Geographical representativeness • Time-related representativeness • Completeness; • Precision/uncertainty; • Methodological Appropriateness and Consistency • Semi-quantitative assessment of data quality
Method	• Completion of Resource Use and Emissions Profile according to this general guide
Documentation	• Compliance with ILCD format
Nomenclature	• Compliance with ILCD nomenclature[11] (e.g. use of ILCD reference elementary flows for IT compatible inventories) (see Annex IV), where available

Review	• For an initial period, the used data shall be reviewed, ideally but not necessarily in conformance with the requirements described in chapter 8
	• For the period after 2015, the used data shall be reviewed by a "Qualified Reviewer" (see chapter 8), who shall possess:
	  • knowledge of relevant sector
	  • knowledge of represented processes, products or facilities
	  • LCA methods expertise and experience
	• Separate review report

[11] ILCD Handbook – Nomenclature and other conventions. Available online at http://lct.jrc.ec.europa.eu/assessment/publications

Semi-quantitative assessment of data quality

The following tables and corresponding equation describe the criteria to be used for a semi-quantitative assessment of data quality.

Table 2: Criteria for semi-quantitative assessment of overall data quality of the Life Cycle Inventory data sets used in the EF study.

Quality level	**Quality rating**	**Definition**	**Completeness** To be judged with respect to the contribution to each environmental impact category and in comparison to a hypothetical ideal data quality **(in case figures are available the figures can be used to assess the quality according to the provided scheme)**	**Methodological compliance and consistency** "The applied LCI methods and methodological choices (e.g. allocation, substitution, etc.) are in line with the goal and scope of the data set, especially its intended applications and decision support context. The methods also have been consistently applied across all data including for included processes, if any."	**Time representativeness** "Degree to which the data set reflects the true population of interest regarding time / age of the data, including for included background data sets, if any." Comment: i.e. of the given year (and - if applicable – of intra-annual or intra-daily differences).	**Technology** representativeness "Degree to which the data set reflects the true population of interest regarding technology, including for included background data sets, if any." Comment: i.e. of the technological characteristics including operating conditions.	**Geographical** representativeness "Degree to which the data set reflects the true population of interest regarding geography, including for included background data sets, if any." Comment: i.e. of the given location / site, region, country, market, continent, etc.	**Precision / uncertainty** (relative standard deviation in % if a Monte Carlo simulation is used, otherwise qualitative expert judgement) Comment: The uncertainty assessment is related to the resource use and emission

				Comment: i.e. correct and consistent application of the recommended LCI modelling framework and LCI method approaches for the given Situation A, according to the ILCD Handbook[12].				data only, not covering the impact assessment.
Very good	1	Meets the criterion to a very high degree, without need for improvement.	Very good completeness (≥ 90 %)	Full compliance with all requirements of the EF guide				**Very low uncertainty (≤ 7 %)**
Good	2	Meets the criterion to a high degree, with little significant need for improvement.	Good completeness ([80 % to 90 %)	Attributional[13] Process based approach AND: Following three method requirements of the EF guide met: • Dealing with multi-functionalit				**Low uncertainty (7 % to 10 %]**

[12] ILCD Handbook – General guide for Life Cycle Assessment – Detailed guidance, Chapter 5.3
[13] Attributional - refers to process-based modeling intended to provide a static representation of average conditions, excluding market-mediated effects.

				y • End of life modelling • System boundary				
Fair	3	Meets the criterion to an acceptable degree, but merits improvement.	Fair completeness ([70 % to 80 %)	Attributional Process based approach AND: Two of the following three method requirements of the EF guide met: • Dealing with multi-functionality • End of life modelling • System boundary				**Fair uncertainty (10 % to 15 %]**
Poor	4	Does not meet the criterion to a sufficient degree, but rather requires improvement.	Poor completeness ([50 % to 70 %)	Attributional Process based approach AND: One of the following three method requirements of the				**High uncertainty (15 % to 25 %]**

				EF guide met: • Dealing with multi-functionality • End of life modelling • System boundary				
Very poor	5	Does not meet the criterion. Substantial improvement is necessary OR: This criterion was not judged / reviewed or its quality could not be verified / is unknown.	Very poor or unknown completeness (< 50 %)	Attributional Process based approach BUT: None of the following three method requirements of the EF guide met: • Dealing with multi-functionality • End of life modelling • System boundary				**Very high uncertainty (> 25 %)**

The overall data quality shall be calculated by summing up the achieved quality rating for each of the quality components. The rating of the weakest quality level is counted 5-fold. The sum is divided by the number of quality components plus 4. The Data Quality Rating result is used to identify the corresponding quality level in Table 3. Formula 1 provides the calculation provision:

Formula 1

$$DQR = \frac{TeR + GR + TiR + C + P + M + X_w * 4}{i + 4}$$

- *DQR* : Data Quality Rating of the data set; see Table 5
- *TeR: Technological Representativeness*
- *GR: Geographical Representativeness*
- *TiR: Time-related Representativeness*
- *C: Completeness;*
- *P: Precision/uncertainty;*
- *M*: Methodological Appropriateness and Consistency
- *Xw* : weakest quality level obtained (i.e. highest numeric value) among the data quality indicators
- *i* : number of data quality indicators

Table 3: Example of semi-quantitative assessment of data quality required for key Life Cycle Inventory data sets.

Process: dyeing process.

Quality level	**Quality rating**	**Definition**	**Completeness**	**Methodological compliance and consistency**	**Time representativeness**	**Technology representativeness**	**Geographical representativeness**	**Precision / uncertainty (relative standard deviation in % if a Monte Carlo simulation is used, otherwise qualitative expert judgement)**
			To be judged in comparison to a hypothetical ideal data quality (in case figures, e.g. from third party data sources, are available the figures can be used to assess the quality according to the provided scheme)	"The applied LCI methods and methodological choices (e.g. allocation, substitution, etc.) are in line with the goal and scope of the data set, especially its intended applications and decision support context. The methods also have been consistently applied across all data including for included processes, if any." Comment: i.e. correct and consistent	"Degree to which the data set reflects the true population of interest regarding time / age of the data, including for included background data sets, if any." Comment: i.e. of the given year (and - if applicable – of intra-annual or intra-daily differences).	"Degree to which the data set reflects the true population of interest regarding technology, including for included background data sets, if any." Comment: i.e. of the technological characteristics including operating conditions.	"Degree to which the data set reflects the true population of interest regarding geography, including for included background data sets, if any." Comment: i.e. of the given location / site, region, country, market, continent, etc.	Comment: The uncertainty assessment is related to the resource use and

				application of the recommended LCI modelling framework and LCI method approaches for the given Situation A, according to the ILCD Handbook.				emission data only, not covering the impact assessment
Very good	1	Meets the criterion to a very high degree, without need for improvement.	Very good completeness (≥ 90 %)	Full compliance with all requirements of the EF guide	2009-2012	Discontinuous with airflow dyeing machines	Central Europe mix	Very low uncertainty (≤ 7 %)
Good	2	Meets the criterion to a high degree, with little significant need for improvement.	Good completeness ([80 % to 90 %)	Attributional Process based approach AND: Following three method requirements of the EF guide met: • Dealing with multi-functionality • End of life modelling • System boundary	2006-2008	e.g. "Consumption mix in EU: 30% Semi-continuous, 50% exhaust dyeing and 20% Continuous dyeing"	EU 27 mix; UK, DE; IT; FR	Low uncertainty (7 % to 10 %]
Fair	3	Meets the criterion to an	Fair completeness	Attributional Process	1999-2005	e.g. "Production mix in EU: 35%	Scandinavian Europe; other	Fair uncertainty

		acceptable degree, but merits improvement.	([70 % to 80 %)	based approach AND: The following two method requirements of the EF guide met: • Dealing with multi-functionality • End of life modelling However, the following one method requirement of the EF guide is not met: • System boundary		Semi-continuous, 40% exhaust dyeing and 25% Continuous dyeing"	EU27 countries	(10 % to 15 %]
Poor	4	Does not meet the criterion to a sufficient degree, but rather requires improvement.	Poor completeness ([50 % to 70 %)	Attributional Process based approach AND: The following one method requirement of the EF guide met: • Dealing with multi-functionality • However, the following two method requirements of the EF	1990-1999	e.g. "Exhaust dyeing"	Middle east; US; JP	High uncertainty (15 % to 25 %]

				guide are not met: End of life modelling • System boundary				
Very poor	5	Does not meet the criterion. Substantial improvement is necessary OR: This criterion was not judged / reviewed or its quality could not be verified / is unknown.	Very poor or unknown completeness (< 50 %)	Attributional Process based approach BUT: None of the following three method requirements of the EF guide met: • Dealing with multi-functionality • End of life modelling • System boundary	<1990; Unknown	Continuous dyeing; other; unknown	Other; Unknown	Very high uncertainty (> 25 %)

Table 4 shall be used to identify the overall data quality level according to the achieved data quality rating.

Table 4: Overall data quality level according to the achieved data quality rating

Overall data quality rating (DQR)	**Overall data quality level**
≤ 1.6	"Excellent quality"
>1.6 to≤ 2.0 [14]	"Very good quality"
>2.0 to ≤3.0	"Good quality"
>3 to ≤4.0	"Fair quality"
>4	"Poor quality"

REQUIREMENT: For the most environmentally significant processes or activities, accounting for at least 70% of contributions to each impact category, both directly collected (specific) and generic data shall achieve at least an overall "good quality" level. A semi-quantitative assessment of data quality shall be performed and reported for these processes. For environmentally significant processes accounting for the subsequent 20% (i.e. from 70% to 90%) of contributions to environmental impacts, at least "fair quality" data shall be used, as assessed via qualitative expert judgment. Remaining data (used for approximation and filling identified gaps (beyond 90% contribution to environmental impacts)) shall be based on best available information.

[14] This means that not all data in the set must achieve a ranking of "good quality" for the data set to achieve an overall "good quality" rating. Rather, two may be ranked as "fair". If more than two are ranked as "fair" or one is ranked as "poor" and one as "fair", the overall data quality of the data set is downgraded to the next quality class, "fair".

Table 5: Overview of requirements for data quality and the assessment of data quality

	Type of required data quality assessment	Minimum data quality required
Data covering at least 70% of contributions to each impact category	Semi-quantitative based on tables 3 and 5	Overall "Good" data quality (DQR ≤ 3.0)
Data accounting for the subsequent 20% (i.e. from 70% to 90%) of contributions to each impact category	Qualitative expert judgment (table 3 can be used to support the expert judgment)	Overall "Fair" data quality
Data used for approximation and filling identified gaps (beyond 90% contribution to each impact category	Qualitative expert judgment (table 3 can be used to support the expert judgment)	

Example for determining the data quality rating.

Component	Achieved quality level	Corresponding quality rating
Technological representativeness (TeR)	good	2
Geographical representativeness (GR)	good	2
Time-related representativeness (TiR)	fair	3
Completeness (C)	good	2
Precision / uncertainty (P)	good	2
Methodological appropriateness and consistency (M)	Good	2

DQR = (TeR+GR+TiR[1]+C+P+M+3*4) / (6[2]+4) = (2+2+3+2+2+2+3*4) / 10 = 2.5

[1] The second occurrence of the lowest level "fair". [2] six indicators / components are counted.

6.7 Specific data collection

Specific data (including average data representing multiple sites whether internally or provided by a supplier) must be obtained for all environmentally significant processes within the defined organisational boundaries and for environmentally significant background processes within the defined Organisation Environmental Footprint boundaries where possible. The data should include all environmentally significant

inputs and outputs for the processes. Inputs are (for example) use of energy, water, materials, etc. Outputs are the products, co-products, and emissions. Emissions can be divided into four categories: emissions to air, to water, to soil, and emissions as solid waste. Specific data can be collected, measured or calculated.

Data collection - measurements and tailored questionnaires

The most representative sources of data for specific processes are measurements directly performed on the process, or obtained from facility operators via interviews or questionnaires. The data may need scaling, aggregation or other forms of mathematical treatment to bring them in relation to the Product/Service Portfolio.

Typical specific data sources include:

- Process or plant level consumption data
- Bills and stock/inventory-changes of consumables
- Emission declared/reported to authorities for legal purposes such as permits or fulfilling reporting requirements like according to the European Pollutant Release and Transfer Register (E-PRTR), or the predecessor European Pollutant Emission Register (EPER)
- Emission measurements (concentrations plus corresponding off-gas and wastewater amounts)
- Composition of waste and products
- Procurement and sale department(s)/unit(s)

REQUIREMENT: Specific data must be obtained for all environmentally significant processes within the defined organisational boundary and for environmentally significant background processes where possible.

1. Specify for which processes specific data has to be collected.

2. Specify the requirements for directly collected data for each environmentally significant process.

3. Define the data collection range for the conditions listed below for each site:

- Target stage(s) and the data collection coverage,
- Location of data collection (domestically, internationally, representative factories, and so on),
- Term of data collection (year, season, month, and so on),
- When the location or term of data collection must be limited to a certain range, provide a reason and show that the collected data will serve as sufficient samples.
-
  - Note: The basic rule is that the location of data collection is all target areas and the term of data collection is a year or more.

6.8 Generic data collection

Generic data refers to data that are not based on direct measurements or calculation for the respective specific process(es). Generic data shall be used only if data for a specific process are unavailable, not environmentally significant, or refer to a process in the background system. Sources of generic data must be documented. Examples of generic data include:

- Data from literature or scientific papers;
- Industry-average life cycle data from life cycle inventory databases, industry association reports, government statistics, etc.

Sourcing generic data

All generic data shall, as far as possible, fulfill the data quality requirements specified in this guidance document. Subject to data quality requirements, generic data should be sourced according to the following hierarchy:

- Data developed in line with the requirements for Organisation Environmental Footprint studies;
- Data developed in line with the requirements for Product Environmental Footprint studies;
- International Reference Life Cycle Data System (ILCD) Data Network (giving preference to "ILCD-compliance" over "ILCD Data Network – entry level" data sets)[15];
- European Reference Life Cycle Database (ELCD)[16];
- Databases provided by international governmental organisations (for example FAO, UNEP);
- National governmental LCI database projects (for data specific to the database host country);
- Other third-party LCI databases;
- Peer-reviewed literature.

If the necessary data cannot be found in the above listed sources, other sources may be used. In any case, the sources of the data used shall be clearly documented and reported in the OEF report.

REQUIREMENT: Generic data shall be used only if data for a specific process are unavailable, not environmentally significant, or refer to a process outside of the defined organisational boundary. Generic data shall, as far as possible, fulfill the data quality requirements specified in this guidance document. Subject to data quality requirements, generic data should be preferentially sourced according to the specified hierarchy.

Example:
Source of generic data: ELCD and ILCD Data network, for the following data sets.

International Reference Life Cycle Data System (ILCD) Data network

Detergent production	Database AA
Dye production	Database CC
Other data sets for Petro chemical industry	US Chemical Association

European Reference Life Cycle Database (ELCD)

[15] http://lct.jrc.ec.europa.eu/assessment/data
[16] http://lct.jrc.ec.europa.eu/assessment/data

Germany electricity grid mix
Ethylene production
Natural gas production

TIP: Proceeding through the hierarchy of priority data sources, once a data set has been identified that fulfills at least the minimum data quality requirements it is not required to search further for higher quality data. However, it is good practice to use the best available data in all cases, hence it is recommended to also check subsequent sources as per the hierarchy for higher quality data. A data set from a source listed lower in the provided hierarchy of data sources can only be used in place of a data set from a source listed higher in the hierarchy if it achieves a higher data quality rating.

The OFSR shall:

- Specify where the use of generic data is permitted as an approximation for a substance for which specific data is not available)
- Specify the level of required similarities between the actual substance and the generic substance
- Specify the combination of more than one generic data sets, if necessary

6.9 Dealing with remaining data gaps / missing data

General

Data gaps exist when there is no available specific or generic data that is sufficiently representative of the given process in question. For most processes where data may be missing, it should be possible to obtain sufficient information to provide a reasonable estimate of the missing data. Therefore, there should be few, if any, data gaps in the final Resource Use and Emissions Profile. Missing information can be of different types and have different characteristics, each requiring separate approaches to resolve.

Data gaps may exist when:

- Data does not exist for a specific input/output, or
- Data exists for a similar process but:
    - The data has been generated in a different region
    - The data has been generated using a different technology
    - The data has been generated in a different time period

How to deal with remaining missing inventory data / information

The organisation identifies environmentally significant/insignificant processes during the initial screening step. If processes are determined to be insignificant based on the screening step (i.e. relative to the established cut-off criteria) and data are unavailable for the process, then the process may be excluded from the inventory results. Documentation of missing data is required.

If processes for which specific data are required are determined to be environmentally significant based on the screening step and specific data of sufficient quality is unavailable for the processes, the data gaps in specific data shall be filled using, in order of preference:

- generic data, subject to the quality provisions for generic data provided in this document

- extrapolated data (e.g., data specific to another process or product that has been adapted or customized to more closely resemble the conditions of the given process in the studied organisations supply chain)

The contribution of such data (generic or extrapolated) shall not account for more than 10% of the overall contribution to each impact category considered.

REQUIREMENT: Data gaps for specific data - Any data gaps for environmentally significant processes shall be filled using generic or extrapolated data that achieves at least a “fair” data quality level rating. Such processes (including generic data gaps) shall not account for more than 10% of the overall contribution to each impact category considered.

REQUIREMENT: Data gaps for generic data - Any data gaps for environmentally significant processes shall be filled using extrapolated data or other data that achieves at least a “fair” data quality level rating. Such processes (including specific data gaps) shall not account for more than 10% of the overall contribution to each impact category considered.

The OFSR shall specify potential data gaps and provide detailed guidance for filling data gaps

6.10 Handling multi-functional processes and facilities

If a process or facility provides more than one function, i.e. it delivers several goods and/or services ("co-products"), it is “multifunctional”. In these situations, all inputs and emissions linked to the process must be partitioned between the product of interest and the other co-products in a principled manner. Similarly, where a jointly owned and/or operated facility produces multiple products, it may be necessary to partition related inputs and emissions among the products within the defined Product/Service Portfolios of different organisations. Organisations undertaking an Organisation Environmental Footprint study may therefore have to address multi-functionality problems both at the product and facility level.

Systems involving multi-functionality of processes shall be modeled in accordance with the following decision hierarchy, with additional guidance at the sectorial level provided by Organisation Environmental Footprint Sector Rules (OFSRs) if available. All choices concerning multi-functionality problems shall be reported and justified with respect to the overarching goal of ensuring physically representative, environmentally relevant analytical outcomes. Fig 5 provides a decision tree for handling multi-functional processes.

Decision hierarchy

I) Subdivision

Subdivision refers to disaggregating multifunctional processes or facilities to isolate the input flows directly associated with each process or facility output. First investigate whether the analyzed process can be

subdivided. Where subdivision is possible, inventory data should be collected only for those unit processes directly attributable to the products/services of concern.

II) Substitution

Substitution refers here to identification and modeling of mono-functional processes which yield functions equivalent to those of the outputs of the multi-functional process of concern. The inventory for each mono-functional process (e.g. each independently produced equivalent of the co-products/services), is subtracted from the inventory of the original multi-functional process in order to isolate the remaining inventory attributable to the process output of concern. In order of preference, substitution shall be based on (a) specific, equivalent alternatives or, (b) a representative market mix of equivalent alternatives. Substitution shall only be applied where a realistic, physically representative substitution scenario can be identified. Such scenarios shall be clearly documented and justified, and their implications for the final results discussed.

III) Allocation

Allocation refers to partitioning the input and output flows of a multi-functional process or facility according to an appropriate, predetermined criterion. In order of preference, the possible criteria for allocation in Organisation Environmental Footprint studies are:

III.a) Allocation Based on a Relevant Underlying Physical Relationship

Allocation based on a relevant underlying physical relationship refers to allocating the input and outflows of a multi-functional process in accordance with a relevant, quantifiable physical relationship between the process inputs and co-product outputs (for example, a physical property of the inputs and outputs that is relevant to the function provided by the co-product of interest).

III.b) Allocation Based on Some Other Relationship

Allocation based on some other relationship may be possible. For example, economic allocation refers to allocating inputs and outputs associated with multi-functional processes to the co-product outputs in proportion to their relative market values. The market price of the co-functions should refer to the specific condition and point at which the co-products are produced. Allocation based on economic value shall only be applied when (I, II and III.a) are not possible. In any case, a clear justification must be provided, with reference to ensuring the physical representativeness of the Organisation Environmental Footprint results.

The decision hierarchy also applies for product recycling (EoL). In cases of substitution, the equation described in Annex III shall be applied.

REQUIREMENT: The Organisation Environmental Footprint multi-functionality decision hierarchy shall be applied for resolving all multi-functionality problems at both process and facility-level. All choices made in this context shall be reported and justified with respect to the overarching goal of ensuring physically representative, environmentally relevant results. For substitution in recycling situations the equation described in Annex III shall be applied. Specific multi-functionality solutions shall be provided in OFSRs, where available.

The OFSR shall further specify multi-functionality solutions for application within the defined organisational boundaries and, where appropriate, for upstream and downstream phases. If feasible/appropriate, then OFSR may further provide specific substitution scenarios or factors to be used in the case of allocation solutions. All such multi-functionality solutions specified in the OFSR must be clearly justified with reference to the OEF multi-functionality solution hierarchy, using the template provided.

Where sub-division is to be applied, the OFSR shall specify which processes are to be sub-divided and according to what principles.

Where substitution is to be applied, the OFSR shall specify the substitution scenarios, including the specific or market-mix substitutes that are required.

Where allocation by physical relationship is to be applied, the OFSR shall specify the relevant underlying physical relationships to be considered, and establish the relevant allocation factors.

Where allocation by some other relationship is to be applied, the OFSR shall specify the relationship and establish the relevant allocation factors. For example, in the case of economic allocation, the OFSR shall specify the rules for determining the economic values of co-products.

In the event that information is sourced from documents derived from PEF of PFCR studies, the multi-functionality solutions used in such studies shall be retained for the data sets of interest.

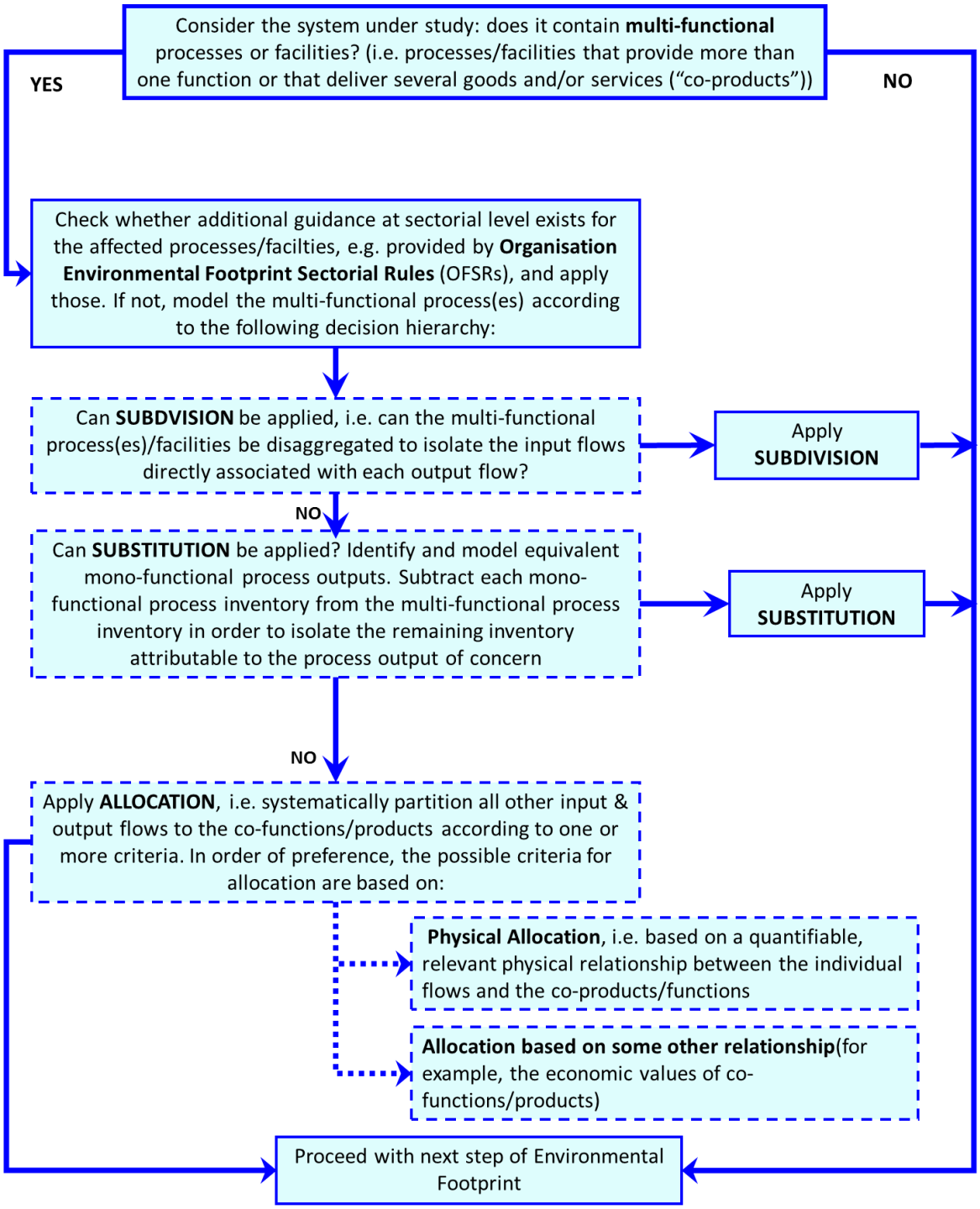
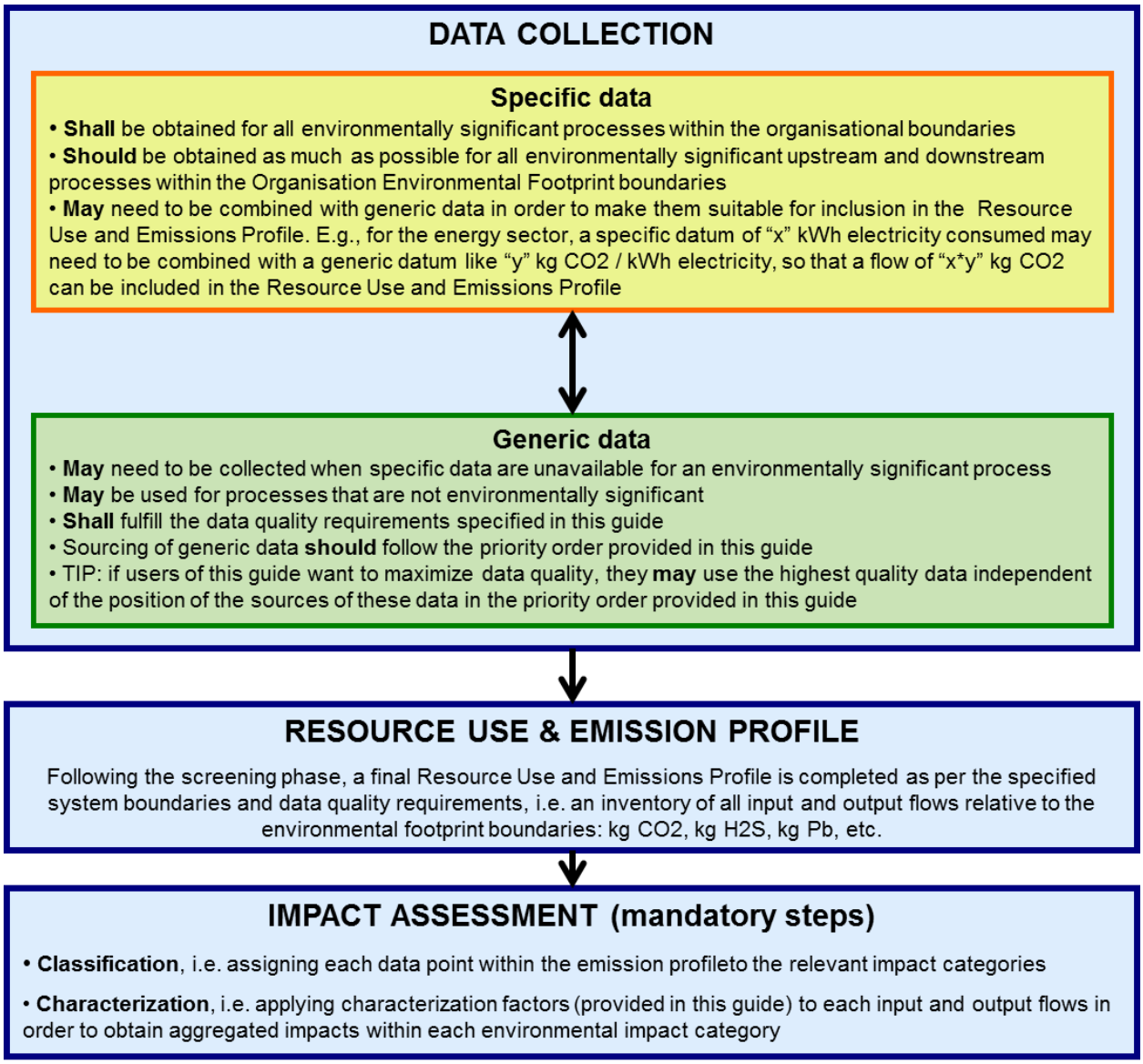


Figure 4: Decision tree for handling multi-functional processes



* **"Environmentally significant process"** are here defined as any process or activity to be included in the Environmental Footprint calculation (i.e. does not qualify for exclusion based on the cut-off criterion on 90% inclusiveness for each environmental footprint impact category)

Figure 5: Relationship between data collection, resource and emission profile and impact assessment in OEF studies

7. Organisation Environmental Footprint Impact Assessment

Once the Resource Use and Emissions Profile has been compiled, the environmental footprint impact assessment phase is undertaken to calculate the environmental performance of the organisation being assessed using the selected Environmental Footprint impact assessment categories and methods. Environmental footprint impact assessment includes two mandatory and two optional steps.

7.1 Mandatory Steps: Classification and Characterisation

Environmental footprint impact assessment involves two mandatory steps:

1. The first step, which is called “classification”, requires assigning each value that has been compiled in the Resource Use and Emissions Profile to the relevant environmental footprint impact categories (chosen during the scope definition phase). Classification for substances for Organisation Environmental Footprint studies can be accessed at WEBLINK TO BE PROVIDED IN FINAL VERSION.

2. The second step, which is called “characterisation”, requires multiplying the value compiled in the Resource Use and Emissions Profile by the relevant characterisation factor for each impact category. This allows aggregation of impact indicators within categories. Characterisation factors for Organisation Environmental Footprint studies can be accessed at WEBLINK TO BE PROVIDED IN FINAL VERSION.

7.1.1 Classification of Environmental Footprint Data

Classification requires assigning the material/energy inputs and outputs tabulated in the Resource Use and Emissions Profile to the appropriate environmental footprint impact category. For example, during the classification phase, all inputs/outputs that result in greenhouse gas emissions are assigned to the Climate Change category, whereas those that result in emissions of ozone depleting substances are classified accordingly. In some cases, an input/output may contribute to more than one environmental footprint impact category (for example, chlorofluorocarbons (CFCs) contribute to both Climate Change and Ozone Depletion).

In principle, as part of the classification of the Resource Use and Emissions profile, data should be expressed in terms of constituent substances for which characterisation factors (see 5.1.2) are available. For example, data for a composite NPK fertilizer should be disaggregated and classified according to its N, P, and K fractions, since each constituent element will contribute to different environmental footprint impact categories. In practice, much of the inventory data used to model the Organisation supply chain of interest may be drawn from existing public or commercial life cycle inventory databases, where classification has already been implemented. In such cases, it must be assured that the classification and linked environmental footprint impact assessment pathways correspond to the requirements specified in this guidance document.

REQUIREMENT: All inputs/outputs tabulated during the compilation of the Resource Use and Emissions Profile shall be assigned to the environmental footprint impact categories to which they contribute ("classification") using the provided classification data.

Example: Classification of data in the climate change impact category

CO_2 g	Yes
CH_4 g	Yes
SO_2 g	No
NO_x g	No

7.1.2 Characterisation of Environmental Footprint Results

Characterisation refers to calculating the magnitude of the contribution of each classified input/output to their respective environmental footprint impact categories, and aggregation of contributions within each category. The characterisation factors are substance/resource-specific. They represent the impact intensity of a substance relative to a common reference substance for an environmental footprint impact category. For example, in the case of calculating climate change impacts, all greenhouse gas emissions tabulated in the Resource Use and Emissions Profile are weighted in terms of their impact intensity relative to carbon dioxide, which is the reference substance for this category. This allows for the aggregation of impact potentials and expression in terms of a single equivalent substance (in this case, CO2-equivalent emissions) for each environmental footprint impact category.

The characterisation models must be scientifically and technically valid, and based upon distinct, identifiable environmental mechanisms or reproducible empirical observations. Moreover, the entirety of characterization factors should have no relevant gaps in coverage for the impact categories to which they relate.

REQUIREMENT: All classified inputs/outputs in each environmental footprint impact category shall be assigned characterisation factors representing the contribution per unit input/output to the category, using the provided characterisation factors. Environmental footprint impact assessment results shall subsequently be calculated for each category by multiplying the amount of each input/output by its characterisation factor and summing contributions of all inputs/outputs within each category to a single measure expressed in terms of an appropriate reference unit.

Example

Characterisation of data for climate change impact category, and calculation of environmental footprint impact assessment result

Global warming

			CF	
CO_2 kg	5,132	x	1	=5.132 Mg CO_{2eq}
CH_4 kg	8.2	x	25	=0.205 Mg CO_{2eq}

SO_2	kg	3.9	x 0	=0 Mg CO_{2eq}
NO_x	kg	26.8	x 0	=0 Mg CO_{2eq}
		Total=		5.337 Mg CO_{2eq}

Eutrophication

..

Eco Toxicity

…

7.2 Optional Steps: Normalisation and Weighting

Following the two mandatory steps of classification and characterisation, the environmental footprint impact assessment may be complemented with two optional steps (as appropriate to or required for the intended application): these are referred to as normalisation and weighting.

7.2.1 Normalisation of Environmental Footprint Impact Assessment Results

Normalisation is an optional step in which the environmental footprint impact assessment results are multiplied with normalisation factors in order to calculate and compare the magnitude of their contributions to the environmental footprint impact categories of concern relative to a reference unit (typically a whole country or an average citizen). As a result, dimensionless, normalised environmental footprint results are obtained. This allows comparisons of the relevance of the contributions made by organisational activities to the environmental impact categories considered.

Normalised environmental footprint results do not, however, indicate the severity/relevance of the respective impacts, nor can they be summed across impact categories (this would assume an implicit one-to-one weighting).

REQUIREMENT: Normalisation is not a required step for Organisation Environmental Footprint studies. If normalisation is applied, the normalised environmental footprint results shall be calculated using the provided normalisation factors. Other normalisation factors can be used in addition to those provided and the results be reported under “additional environmental information”.

The organisation shall not aggregate the normalised results as this implicitly applies a weighting factor (i.e. one).

7.2.2 Weighting of Environmental Footprint Impact Assessment Results

Weighting is an additional, but not required, step that may support the interpretation and communication of the results of the analysis. In this step, normalised environmental footprint results are multiplied by a set of weighting factors which reflect the perceived relative importance of the impact categories considered. Weighted environmental footprint results can then compared to assess their relative importance. They can also be summed across impact categories to obtain a single-value overall impact indicator.

In contrast to the preceding, natural sciences-based phases (classification, characterisation), weighting requires value judgements as to the respective importance of the environmental impact categories considered. These judgments may be based on expert opinion, cultural/political view points, or economic considerations.

Application of normalisation and weighting steps in Organisation Environmental Footprint studies must be consistent with the defined goals and scope of the study, including the intended applications. It should be noted that ISO 14040 and 14044 do not permit the use of weighting in support of comparative assertions[17].

REQUIREMENT: Weighting is not a required step for Organisation Environmental Footprint studies. If weighting is applied, the environmental footprint results shall be multiplied by the weighting factors provided. Other weighting factors can be used in addition to those provided. Weighted results shall be reported as "additional environmental information, with all methods and assumption documented. Results of the environmental footprint impact assessment prior to weighting have to be reported alongside weighted results.

8. Organisation Environmental Footprint Interpretation

8.1 General

Interpretation of the results of the Organisation Environmental Footprint study serves two purposes:

- The first is to ensure that the environmental footprint model corresponds to the goals and quality requirements of the study. In this sense, interpretation may inform iterative improvements of the environmental footprint model until all goals and requirements are met;
- The second purpose is to derive robust conclusions and recommendations from the analysis, e.g. in support of environmental improvements.

To meet these objectives, the interpretation phase may be broken down into two key steps: "Identification of significant issues" and "Conclusions, limitations and recommendations".

8.2 Identification of Significant Issues

Identification of significant issues refers to:

- Identifying the methodological considerations and choices that may significantly influence the accuracy of the calculated Organisation Environmental Footprint results; and
- Identifying the main contributing elements to the calculated results in support of answering the study questions and assessing improvement potentials.

[17] http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_tc_browse.htm?commid=54808

Identifying key methodological considerations requires assessing the extent to which methodological choices such as system boundaries, cut-off criteria, data sources, and allocation choices influence the analytical outcomes. It must be ensured that these correspond to the requirements specified in this guidance document, and that they are appropriate to the context.

Tools that should be used to assess the robustness of the Organisation Environmental Footprint model include:

- Completeness checks: assess the inventory data to ensure that it is complete relative to the defined goals, scope, system boundaries, cut-off criteria and quality criteria. This includes completeness of process coverage (i.e. all relevant processes at each supply chain stage considered have been included) and input/output coverage (i.e. all environmentally significant material or energy inputs and emissions associated with each process have been included).

- Sensitivity checks: assess the extent to which the results are determined by specific methodological choices, and the impact of implementing alternative, defensible choices where these are identifiable. It is useful to structure sensitivity checks for each phase of the Organisation Environmental Footprint study, including goal and scope definition, the Resource Use and Emissions Profile, and environmental footprint impact assessment.

- Consistency checks: assess the extent to which assumptions, methods, and data quality considerations have been applied consistently throughout the Organisation Environmental Footprint study.

Any issues flagged in this evaluation should inform iterative improvements to the model.

Once it has been ensured that the Organisation Environmental Footprint model is robust and conforms with all aspects defined in the goal and scope definition phases, the next step is to identify the main contributing elements to the Organisation Environmental Footprint results. This step may also be referred to as “hot spot” or “weak point” analysis. Contributing elements may be specific elements of the Product/Service Portfolio, life cycle stages, processes, or individual material/energy inputs/outputs associated with a given stage or process in the Organisation supply chain. These are identified by systematically reviewing the Organisation Environmental Footprint study results. Graphical tools may be particularly useful in this context. Such analyses provide the necessary basis to identify improvement potentials associated with specific management interventions.

REQUIREMENT: Significant methodological issues shall be evaluated using a combination of completeness and consistency checks, as appropriate. Organisation Environmental Footprint results shall subsequently be evaluated to assess supply chain hotspots/weak points on input/output, process, and supply chain stage bases and to assess improvement potentials.

8.3 Identifying Uncertainty

Estimating uncertainties supports iterative improvement of Organisation Environmental Footprint studies. It also helps the target audience of the Organisation Environmental Footprint study results to assess their robustness and applicability.

There are two key sources of uncertainty in Organisation Environmental Footprint studies. Each type of uncertainty must be accommodated separately.

(1) Stochastic uncertainties for inventory data or characterisation factors

Stochastic uncertainties (both parameter and model) refer to statistical descriptions of variance around a mean. For normally distributed data, this variance is typically described in terms of an average and standard deviation. Organisation Environmental Footprint results that are calculated using average data (i.e. the mean of multiple data points for a given process) or using characterisation factors with known associated variance do not reflect the uncertainty associated with such variance. However, uncertainty may be estimated and communicated using appropriate statistical tools.

In practice, it may be difficult to access estimates of uncertainty for all data used in an Organisation Environmental Footprint study. At a minimum, efforts to accurately characterize stochastic uncertainty and its impact on modeling outcomes should focus on those processes identified as environmentally significant in the environmental footprint impact assessment and interpretation phases.

(2) Choice-related uncertainties

Choices-related uncertainties arise from methodological choices including modeling principles, system boundaries and cut-off criteria, choice of environmental footprint impact assessment methods, and other assumptions related to time, technology, geography, etc. These are not amenable to statistical description, but rather can only be characterized via scenario model assessments (e.g., modeling worst and best-case scenarios for significant processes) and sensitivity analyses.

REQUIREMENT: A qualitative description of uncertainties shall be provided.

TIP: Quantitative uncertainty assessments may be calculated for variance associated with environmentally significant processes using Monte Carlo simulations or other appropriate tools. The influence of choice-related uncertainties may be estimated at the upper and lower bounds using scenario model assessments. These should be clearly documented and reported.

8.4 Conclusions, Recommendations and Limitations

The final aspect of the interpretation phase is to draw conclusions based on the results, answer the questions posed at the outset of the Organisation Environmental Footprint study, and advance recommendations appropriate to the intended audience and context whilst explicitly taking into account any limitations to the robustness and applicability of the results.

As required under ISO 14044:2006, if the results of the Organisation Environmental Footprint study are intended to support comparative assertions (i.e. claims about the environmental superiority or equivalence of organisations compared to other organisations) they must be based on this OEF guidance AND related Organisation Footprint Sectorial Rules (OFSRs). For any comparative assertions it is essential to carefully consider whether any differences in data quality and methodological choices used to model the compared organisations may influence the comparability of the outcomes. Any inconsistencies in defining system boundaries, inventory data quality, or environmental footprint impact assessment must be considered and documented/reported.

Conclusions derived from the Organisation Environmental Footprint study should include a summary of identified supply chain "hotspots" and the improvement potentials associated with possible management interventions. The improvement potentials may be linked to, for example, cleaner technology techniques, EMAS or ISO 14001, or other systematic approaches.

REQUIREMENT: Conclusions, recommendations and limitations shall be described in accordance with the defined goals and scope of the Organisation Environmental Footprint study. Organisation Environmental Footprint studies intended to support comparative assertions (i.e. claims about the environmental superiority or equivalence of organisations compared to other organisations) cannot be made on the basis of studies using only the OEF guide but rather shall be based both on this OEF guidance AND related Organisation Footprint Sector Rules (OFSRs).

9. Organisation Environmental Footprint Reports

9.1 General

An Organisation Environmental Footprint report provides a relevant, complete, consistent, accurate, and transparent account of the study and of the calculated environmental impacts associated with the organisation of concern. It reflects the best possible information in such a way as to maximize its usefulness to intended users, whilst honestly and transparently communicating limitations.

Effective Organisation Environmental Footprint reporting requires the satisfaction of several criteria, both procedural (report quality) and substantive (report content). The reported information must also provide a robust basis for assessing, tracking, and seeking to improve the environmental performance of the organisation. Towards this end, a combination of performance metrics will be useful.

For the purposes of tracking and seeking to improve performance, it is helpful to distinguish between absolute and intensity-based metrics. Absolute metrics convey the total contribution of organisation to the environmental impact categories of concern. An example of an absolute metric would be the total greenhouse gas emissions associated with Organisation activities over a specified interval. Absolute metrics support management decisions associated with overall environmental performance objectives. In contrast, intensity-based metrics refer to environmental impacts per unit good/service produced or other reference unit. These are most useful from a resource and waste efficiency perspective, and for tracking relative environmental performance improvements at the organisational level.

Benchmarking and Performance Tracking

Organisations should define indicators appropriate to tracking and reporting environmental performance in formats that are accessible and relevant to stakeholders, and that facilitate improved environmental management. Selection of indicators should be guided by the following considerations (adopted from EMAS):

- Does the indicator represent a significant aspect of the environmental impact of the organisation?
- Can the indicator enable the quantification of environmental targets?
- Does the indicator support the management process of the organisation?
- Is the indicator understandable without complicated explanation?
- Will data provided by the indicator be usable year on year?
- Are any existing legal limits for this aspect of environmental performance incorporated?
- Can the indicator be compared with relevant benchmarks for this aspect of environmental performance?

To facilitate benchmarking and performance tracking for management with respect to defined environmental goals and objectives, it may also be appropriate to establish a base-year against which to report environmental performance, along with rules for changes to base-years and subsequent recalculations.

Obligatory sectorial indicators will be defined in Organisation Environmental Footprint Sectorial Rules as they are developed.

REQUIREMENT: Organisations applying the Organisation Environmental Footprint method shall choose and justify a base year for the purpose of setting targets and tracking progress. The base year must be chosen so as to ensure comparable quality and quantity of data for all reporting intervals considered. The organisation shall develop a base year environmental footprint recalculation policy that describes and defends the basis and context for any recalculations. Organic growth or decline shall not be used as a basis for base year recalculations.

Organisations shall report study outcomes, targets, and progress using both absolute and intensity-based performance indicators. Where possible, organisations shall report trends representing at least three years of data, including the base year, when such data is available. Organisations shall define short-term and long-term targets for footprint reductions for each criterion measured.

The OFSR shall specify any additional reporting requirements for OEF studies, including:

- Rules for establishing the base year and, if necessary, changing the base year and making recalculations with respect to the new base year
- Required formats and units for reporting environmental footprint impact assessment results
- Required formats and units for reporting additional absolute and intensity metrics, using

indicators appropriate for sectorial reporting

- Minimum sectorial reporting requirements
- Rules for assertions regarding environmental performance in the sector

9.2 Reporting elements

An Organisation Environmental Footprint report begins with a clear description of the goal and scope of the OEF, including system boundaries, methodologies, data sources, assumptions, results and limitations, in conformance with the OEF guide. Moreover, the reported information should be presented using appropriate formats and nomenclature. Finally, the Organisation Environmental Footprint report should contextualize the study and results with reference to the organisation's environmental policy and management systems.

The Organisation Environmental Footprint report consists of at least four elements: the Main Report, which is additionally condensed into a Technical Summary and an Executive Summary, and an Annex that documents e.g. assumptions and data (which can also be referenced). Confidential and proprietary information can be documented in a fifth element, a complementary confidential report. Review reports are either annexed as well or referenced.

First element: Executive Summary

The executive summary shall be able to stand alone without compromising the results and conclusions/recommendations (if included).

The executive summary shall, at a minimum, include key elements of the goal and scope of the study. The main results from the inventory and impact assessment components shall be presented in a manner so as to ensure the proper use of the information, and relevant statements about data quality, assumptions and value judgments should be included.

Finally, the executive summary report should state any recommendations made and conclusions drawn, and shall specify any limitations that may apply.

Second element: Technical Summary

This technical summary shall be able to stand alone without compromising the results of the environmental footprint study. The technical summary should therefore also fulfill the same criteria about transparency, consistency, etc. as the detailed report.

The technical summary shall, at a minimum, include the goal, the scope, with relevant limitations and assumptions, an overall flow diagram of the system studied, and shall clearly indicate what has been achieved by the study. The main results from the inventory and impact assessment components shall be presented in a manner to ensure the proper use of the information, and statements about data quality and value judgments shall be included.

Finally, the technical summary shall specify any recommendations made and conclusions drawn.

Third element: Main Report

The Main Report shall include the following components:

- Goal of the study: The report shall include clear and concise statements with respect to the following aspects:

- Intended application(s)
- Reasons for carrying out the study
- Target audience
- Commissioner of the study

- Scope of the study

The Scope chapter should identify the analyzed organisation in detail and address the overall approach used to establish the system boundaries. The scope chapter should also address data quality requirements. Finally, the scope chapter should include a description of the methods applied for assessing potential environmental impacts and which impact categories, methods, normalisation and weighting sets are included. Mandatory reporting elements are:

- Description of the Organisation and defined Product/Service Portfolio
- System boundaries (organisational and Organisation Environmental Footprint boundaries) and cut-off criteria
- The reasons for and potential significance of any exclusions
- All assumptions and value judgments, along with justifications for the assumptions made
- Data representativeness, appropriateness of data, and types/ sources of required data and information
- Impact assessment methods, normalisation basis and weighting set (if used)

- Compiling and recording the Resource Use and Emissions Profile

Mandatory reporting elements are:

- Flow diagram (should clearly describe the modeled system, and all major inputs and outputs)
- Description and documentation of all specific data collected

- Calculating Organisation Environmental Footprint impact assessment results

  - Documentation of environmental footprint impact assessment methods and characterisation factors
  - If included, normalisation and weighting factors and results

- Interpretation

  - Significant issues
  - Completeness check
  - Sensitivity check (of achieved accuracy and precision)
  - Consistency check
  - Conclusions
  - Recommendations and improvement potentials

Other key information to include in the Main Report is:

- Organisation's environmental policy
- Description of organisations' management systems
- Key environmental impacts
- Environmental performance indicators

- Targets for improvement/ progress against previous targets
- Interactions/communication with stakeholders
- Status of legal compliance with relevant environmental regulations
- Statement of independent verification of report content

Fourth element: Annex

The annex serves to document elements that would inappropriately interrupt the reading flow of the main report, and which are of a more technical nature. It should include:

- Questionnaire / data collection template and raw data
- Descriptions of all assumptions
- Review report (if conducted) / answers to the review report (if any)

This should include those assumptions that have been shown to be irrelevant. The important ones are to be considered in the sensitivity analysis and interpretation.

- Full Resource Use and Emissions Profile (optional if considered sensitive and communicated separately in the Confidential Report)

Fifth element: Confidential report

The confidential report should contain all those data and information that are confidential or proprietary and cannot be made externally available. It shall be made available to the critical reviewers subject to confidentiality agreements.

REQUIREMENT: The study report shall include, at a minimum, an Executive Summary, a Technical Summary, the Main Report, Annexes, and any other necessary supporting information.

For an example Organisation Environmental Footprint report template, see Annex V.

10. Organisation Environmental Footprint Review

10.1 General

Critical review is important to ensuring the reliability of the Organisation Environmental Footprint results. This not only increases the credibility and acceptance of the Organisation Environmental Footprint study, but also helps improve its quality. Close interaction between the organisation and the reviewer is therefore vital for an efficient and effective review process.

The critical review shall serve to assure that:

- The methods used to carry out the Organisation Environmental Footprint study are consistent with this guidance document;
- The methods used to carry out the Organisation Environmental Footprint study are scientifically and technically valid;

- The data used are appropriate, reasonable and meet the defined data quality requirements;
- The interpretation of results reflects the results and the limitations identified; and
- The study report is transparent, accurate and consistent.

10.2 Review Type

The most suitable review type that provides the required minimum guarantee of quality assurance is an independent external review. The type of review conducted should be informed by the goals and intended applications of the Organisation Environmental Footprint study.

REQUIREMENT: If intended for external use, the study shall be reviewed by an independent and qualified external reviewer (or review team).

The OFSR document shall define the process for stakeholder consultation and review.

The OFSRs shall be reviewed by qualified reviewer(s) with a selected stakeholder panel. The review of OFSR documents shall demonstrate that OFSRs:

- are developed in accordance with the Organisational Environmental Footprint guide
- give a relevant description of the significant environmental aspects for the sector
- that the specified requirements include all the mandatory elements as described in OEF guide
- include a consultation procedure for relevant selected stakeholders

10.3 Reviewer Qualification

The assessment of reviewer qualification is based on a scoring system taking into account review and audit practice, LCA methodology and practice, and knowledge of relevant technologies, processes or other activities represented by the studied organisation and its Product/Service Portfolio.

Table 6 presents the scoring system for each relevant competence and experience topic. Unless otherwise specified in the context of the intended application, reviewer self-declaration based on the scoring system constitutes the minimum requirement. The minimum qualification to act as a reviewer of an Organisation Environmental Footprint study is satisfied by achieving a total score of SIX or more points, including at least ONE point for each of the three mandatory elements (i.e. verification and audit practice, EF or LCA methodology and practice, and technologies or other activities relevant to the Organisation Environmental Footprint study).

If one reviewer alone does not fulfill the requirements for reviewers specified below, the review framework allows for having more than one reviewer to jointly fulfill the requirements, forming a "review team".

Table 6: Scoring system for eligible reviewers/review teams and for qualification as a potential member of a review team.

Topic		Criteria	Score (points) 0	1	2	3	4
Manda-tory criteria	Verification and audit practice						
		Years of experience[1]	0-<3	3 – <4	5 – <9	9 – 14	> 14
		Number of reviews[2]	0-<3	3 – <6	6 – <16	16 – 30	> 30
	EF or LCA methodology and practice	**Years of experience[3]**	0-<3	3 – <5	5 – <9	9 – 14	> 14
		"Experiences" of participation in LCA work	0-<5	5 – <9	9 – <16	16 – 30	> 30
	Technologies or other activities relevant to the Organisation Environmental Footprint study	**Years of experience[4*] in private or public sector**	0-<3 (within the last 10 years)	3 – <6 (within the last 10 years)	6 – <11 (within the last 20 years)	11 – 20	> 20
Other[6]	Verification and audit practice	Optional scores relating to audit	▪ 2 points: Accreditation as third party reviewer for at least one EPD Scheme, ISO 14001, or other EMS. ▪ 1 point: Attended courses on environmental audits (at least 40 hours). ▪ 1 point: Chair of at least one review panel (for LCA studies or other environmental applications). ▪ 1 point: Qualified trainer in environmental audit course.				

Notes:

1) Years of experience in the field of environmental review and auditing.

2) Number of reviews for ISO 14040/14044 compliance, ISO 14025 compliance (Environmental Organisation Declarations (EPD)), or LCI data sets.

3) Years of experience in the field of LCA work, starting from University degree (Masters or equivalent) or Bachelor degree if Master's thesis predominantly includes LCA work.

4) Years of experience in a sector related to the studied Organisation (s. The qualification of knowledge about technologies or other activities is assigned according to the classification of NACE codes (*Regulation (EC) No 1893/2006 of the European Parliament and of the Council of 20 December 2006 establishing the statistical classification of economic activities NACE Revision 2*). Equivalent classifications of other international organisations can also be used. Experience gained with technologies or processes in any sub-sector are considered valid for the whole sector.

5) Years of experience in the public sector, e.g. research centre, university, government relating to the studied Organisation (s)

* Candidate needs to calculate years of experience based on employment contracts. For example, Prof A works in University B part-time from Jan 2005 until Dec 2010 and part-time at a refinery organisation. Prof A can count years of experience in private sector as 3 years and 3 years for public sector (university).

6) The additional scores are complementary.

REQUIREMENT: A review of the Organisation Environmental Footprint study shall be conducted as per the requirements of the intended application. Unless otherwise specified, the minimum necessary score to qualify as a reviewer is 6 points, including at least 1 point for each of the three mandatory criteria (i.e. verification and audit practice, EF or LCA methodology and practice, and technologies or other activities relevant to the Organisation Environmental Footprint study). Reviewers or panels of reviewers must provide a self-declaration of their qualifications, stating how many points they achieved for each criteria.

11. Acronyms and Abbreviations

ADEME	Agence de l'Environnement et de la Maîtrise de l'Energie
B2B	Business to Business
B2C	Business to Consumer
BSI	British Standards Institution
CDP	Carbon disclosure project
CFCR	Organisation Footprint Category Rules
ELCD	European Reference Life Cycle Database
ILCD	International Reference Life Cycle Data System
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
PAS	Publicly Available Specification
PEF	Product Environmental Footprint

WRI	World Resources Institute
WBCSD	World Business Council for Sustainable Development

12. Glossary

Additional Environmental Information – Environmental impact categories and other environmental indicators that are calculated and communicated alongside Organisation Environmental Footprint results.

Acidification - Impact category that addresses impacts due to acidifying substances in the environment. Emissions of NO_x, NH_3 and SO_x lead to releases of hydrogen ions (H^+) when the gases are mineralized. The protons contribute to acidification of soils and water when they are released in areas where the buffering capacity is low, resulting in forest decline and acidified lakes.

Allocation – An approach to solving multi-functionality problems. Refers to partitioning the input flows of a process or facility between the multiple outputs.

Attributional - refers to process-based modeling intended to provide a static representation of average conditions, excluding market-mediated effects.

Average Data – Refers to a production-weighted average of specific data. Example: A pharmaceutical organisation compiles production-weighted average data for twenty of their factories producing acetylsalicylic acid.

Background System – Refers to those stages of the organisations supply chain for which no direct information access is possible. For example, most of the upstream supply-chain processes and generally all processes further downstream will be considered part of the background system.

Best environmental management practice: means the most effective way to implement the environmental management system by organisations in a relevant sector and that can result in best environmental performance under given economic and technical conditions. [EMAS regulation]

Characterisation - Calculating the magnitude of the contribution of each classified input/output to their respective environmental footprint impact categories, and aggregation of contributions within each category. This requires a linear multiplication of the inventory data with *characterisation factors* for each substance and environmental footprint impact category of concern. For example, with respect to the environmental footprint impact category "climate change", CO_2 is chosen as reference substance and the reference unit is kg CO_2-equivalents.

Classification - Assigning the material/energy inputs and outputs tabulated in the Resource and Emissions Profile to environmental footprint impact categories according to each substances potential to contribute to each of the environmental impact categories considered.

Comparative Assertions – A statement of overall superiority or equivalence of organisations concerning the relative environmental performance, based on the results of an Organisation Environmental Footprint study.

Cradle to Gate - An assessment of a partial Organisation supply chain, from the extraction of raw materials (cradle) up to the manufacturer's "gate". The distribution, use stage and stage phase of the supply chain are omitted.

Cradle to Grave - An assessment, including raw material extraction, processing, distribution, storage, use, and disposal or recycling phases. All relevant inputs and outputs are considered for all of the stages of the life cycle.

Cradle to Cradle - A specific kind of cradle-to-grave assessment, where the end-of-life disposal step for the product is a recycling process.

Cut-off Criterion - Specification of the amount of material or energy flow or the level of environmental significance associated with processes to be excluded from an Organisation Environmental Footprint study.

Data Quality - Characteristics of data that relate to their ability to satisfy predefined quality requirements. Data quality covers various aspects, such as technological, geographical and time-related representativeness, as well as completeness and precision of the inventory data.

Directly attributable – refers to a process, activity or impact occurring with the defined Organisational Boundary

Downstream – occurring along the supply chains of sold goods/services after exiting the Organisational Boundary

Ecotoxicity: Impact category that addresses toxic impacts on an ecosystem, damaging individual species and changing the structure and function of the ecosystem. Ecotoxicity is a result of a variety of different toxicological mechanisms caused by release of all substances with a direct effect on the health of the ecosystem.

Environmental aspect: an element of an organisation's activities, products or services that has or can have an impact on the environment. [EMAS regulation]

Environmental Footprint Impact Category – Class of resource use or environmental impact to which the Resource Use and Emissions Profile data are related.

Environmental Footprint Impact Assessment Method – Protocol for quantitative translation of Resource Use and Emissions Profile data into contributions to an environmental impact of concern.

Environmental impact - any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services. [EMAS regulation]

Environmental performance - the measurable results of an organisation's management of its environmental aspects. [EMAS regulation]

Environmentally significant – any process or activity to be included in the Environmental Footprint calculation (i.e. does not qualify for exclusion based on the cut-off criterion of 90% inclusiveness for each environmental footprint impact category)

Eutrophication - Nutrients (mainly nitrogen and phosphorus) from sewage outfalls and fertilized farmland accelerate the growth of algae and other vegetation in water. The degradation of organic material consumes oxygen resulting in oxygen deficiency and, in some cases, fish death. Eutrophication translates the quantity of emission of substances into a common measure expressed as the oxygen required for the degradation of dead biomass.

Extrapolated Data – Refers to data from a given process that is used to represent a similar process for which data is not available, on the assumption that it is reasonably representative

Foreground System – Refers to those stages of the Organisation life cycle for which direct information access is available. For example, the producer's site and other processes operated by the organisation or contractors (e.g. goods transport, head-office services, etc.) belong to the foreground system.

Functional Unit - The functional unit defines the qualitative and quantitative aspects of the function(s) and/or service(s) that the organisation being evaluated provides; the functional unit definition answers the questions "what?", "how much?", "how well?", and "for how long?"

Gate to Gate - A partial assessment looking only at the processes within a specific organisation or site.

Generic Data – Refers to data that is not directly collected, measured, or estimated, but rather sourced from a third-party life cycle inventory database or other source that complies with the data quality requirements of the Organisation Environmental Footprint method. Synonymous with "secondary data." Example: An organisation operating a facility that purchases acetylsalicylic acid from a number of regional firms on a least-cost basis as an input to their production process sources generic data from a life cycle inventory database to represent average acetylsalicylic acid production conditions in the region of interest.

Global Warming Potential – Capacity of a greenhouse gas to influence radiative forcing, expressed in terms of a reference substance (for example, CO_2-equivalent units) and specified time horizon **(**e.g. GWP 20, GWP 100, GWP 500, for 20, 100, and 500 years**).** Relates to capacity to influence changes in the global, average surface-air temperature and subsequent change of various climate parameters and their effects such as storm frequency and intensity, rainfall intensity and frequency of flooding, etc.

Human Toxicity –cancer – impact category that accounts for the adverse health effects on human beings caused by intake of toxic substances through inhalation of air, food/water ingestion, penetration through the skin as far as they are related to cancer

Human Toxicity- non cancer - Impact category that accounts for the adverse health effects on human beings caused by intake of toxic substances through inhalation of air, food/water ingestion, penetration through the skin as far as they are related to non-cancer effects that are not caused by particulate matter/respiratory inorganics or ionizing radiation.

Indirectly attributable – refers to a process, activity or impact occurring outside of the defined Organisational boundary but within the defined Organisation Environmental Footprint boundary (i.e. upstream or downstream)

Ionising Radiation, human health – Impact categories that accounts for the adverse health effects on human health caused by radioactive releases.

Land Use - Impact category related to use (occupation) and conversion (transformation) of land area by activities such as agriculture, roads, housing, mining, etc. Land occupation considers the effects of the land use, the amount of area involved and the duration of its occupation (quality-changes multiplied with area and duration). Land transformation considers the extent of changes in land properties and the area affected (quality changes multiplied with the area).

Life Cycle Approach - Refers to taking into consideration the spectrum of resource flows and environmental interventions associated with a product, service, or organisation from a supply chain perspective, including all phases from raw material acquisition through processing, distribution, use, and end-of-life processes, and all relevant related environmental impacts (in place of focusing on a single issue)

Life Cycle Impact Assessment (LCIA) - Phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a system throughout the life cycle [ISO 14044:2006]. The employed LCIA methods provide impact characterisation factors for elementary flows to aggregate the impact to a limited number of midpoint and/or damage indicators.

Life Cycle Inventory - Phase of life cycle assessment involving the compilation and quantification of inputs and outputs (mass and energy basis) for a given system throughout its life cycle.

Loading rate:- Ratio or capacity e.g. mass or volume that vehicle carry per trip

Normalisation – After the characterisation step, normalisation is an optional step in which the LCIA results are multiplied with normalisation factors that represent the overall inventory of a reference unit (e.g., a whole country or an average citizen). Normalized LCIA results express the relative shares of the impacts of the analyzed system in terms of the total contributions to each impact category per reference unit. When displaying the normalised LCIA results of the different impact topics next to each other, it becomes evident which impact categories the analyzed system affects most, and least. Normalized LCIA results reflect only the contribution of the analyzed system to the total impact potential, not the severity/relevance of the respective total impact. Normalized results are dimensionless, but not additive.

Organisation Environmental Footprint Sector Rules (OFSRs)– are sector-specific, life cycle based rules that complement general methodological guidance for Organisation Environmental Footprint studies by providing further specification at the sectorial level. CFCRs can help shifting the focus of the Organisation Environmental Footprint study towards those aspects and parameters that matter the most, and hence contribute to increased relevance, reproducibility and consistency.

Ozone Depletion Impact category that accounts for the degradation of stratospheric ozone due to emissions of ozone depleting substances, for example long-lived chlorine and bromine containing gases (e.g. CFCs, HCFCs, Halons).

Particulate Matter/Respiratory Inorganics – Impact categories that accounts for the adverse health effects on human health caused by emissions of Particulate Matter (PM) and its precursors (NO_x, SO_x, NH_3)

Photochemical Ozone Formation – Impact category that accounts for the formation of ozone at the ground level of the troposphere caused by photochemical oxidation of Volatile Organic Compounds (VOCs) and carbon monoxide (CO) in the presence of nitrogen oxides (NO_x and sunlight. High concentrations of ground-level tropospheric ozone damage vegetation, human respiratory tracts and manmade materials through reaction with organic materials.

Resource Depletion - Impact category that addresses use of natural resources, either renewable or non-renewable, and either biotic or abiotic.

Reference Flow – measure of the outputs from processes in a given system required to fulfill the function expressed by the functional unit

Resource Use and Emissions Profile – Refers to the inventory of data collected to represent the inputs and outputs associated with each stage of the Organisation supply chain of concern. The Resource Use and Emissions Profile includes three types of data: specific data, average data, and generic data.

Significant Environmental Aspect: an environmental aspect that has or can have a significant environmental impact. [EMAS regulation]

Soil Organic Matter (SOM) – is the measure of the content of organic material in soil. This derives from plants and animals and comprises all of the organic matter in the soil exclusive of the material that has not decayed.

Specific Data – Refers to directly measured or collected data representative of activities at a specific facility or set of facilities. Synonymous with "primary data."
Example: A pharmaceutical organisation compiles data from internal inventory records to represent the material and energy inputs and emissions from a factory producing acetylsalicylic acid.

System Boundary – Definition of aspects included or excluded from the study. For example, for a "cradle-to-grave" environmental footprint analysis, this should include all activities from extraction of raw materials through processing, manufacturing, use, repair and maintenance processes as well as transport, waste treatment and other purchased services such as e.g. cleaning and legal services, marketing, production and decommissioning of capital goods, operation of premises such as retail, storage, administration offices, staff commuting, business travel, and end-of-life processes.

Upstream – occurring along the supply chain of purchased goods/services prior to entering the Organisational Boundary

Weighting - Weighting is an additional, but not required, step that may support the interpretation and communication of the results of the analysis. Normalized Organisation Environmental Footprint results are multiplied by a set of weighting factors, which reflect the perceived relative importance of the impact categories considered. Weighted environmental footprint results can be directly compared across impact categories, and also summed across impact categories to obtain a single-value overall impact indicator. In contrast to the preceding, natural sciences-based phases (classification, characterisation), weighting requires value judgements as to the respective importance of the environmental footprint impact categories considered. These judgments may be based on expert opinion, social science methods, cultural/political view points, or economic considerations.

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Annex I: Calculation of CO_2 emissions from land transformation

(Source: IPCC 2007; as adapted in EC 2010: ILCD Handbook; General guide for Life Cycle Assessment – Detailed guidance, Annex B)

Many aspects influence emissions from land transformations. Their combinations result in the native soil carbon stock, varied by four further influence factors:

- Native soil carbon stock factors (climate region and soil type (Table 7),
- land use factor (land use type, temperature regime, and moisture regime (Table 8)), and
- management factor (specific land management for cropland and for grassland (Table 9 and Table 10), and the related
- input level factor (in variation of the above named land management types, in the same tables).

These aspects and resulting factors are derived from the most recent available related IPCC reports and are included in the tables below. CO_2 emissions from any land transformation can be easily calculated by calculating the difference of the steady-state soil carbon content between the land use before and after transformation. This number is then to be multiplied by 44/12 to convert C-losses stoichiometrically to CO_2 emissions. The steady-state carbon stock of each land use is calculated by simple multiplication of its basic soil carbon stock with the loss factors.

Formula 2 and Formula 3 serve to calculate the soil organic carbon stock of the initial and final land use. Formula 6 provides the final prescription.

Formula 2 $$SOCi = SOCn * LUF_1 * LMF_1 * IL_1$$

with

- *SOCi* = Initial soil organic carbon stock of initial land use "1", given in [t/ha]
- *SOCn* = Native soil organic carbon stock (climate region, soil type); Table 10, given in [t/ha]
- *LUF* = Land use factor; Table 8, dimensionless
- *LMF* = Land management factor; Table 9 and Table 10, dimensionless
- *IL* = Input level factor; also Table 9 and Table 10, dimensionless

Formula 3 $$SOCf = SOCn * LUF_2 * LMF_2 * IL_2$$

with

- *SOCf* = Final soil organic carbon stock of land use "2", i.e. after transformation, given in [t/ha]

Formula 4 $$CO2 = (SOCi - SOCf) * \frac{44}{12}$$

with

- CO2 = resulting CO_2 emissions from soil (given in [t/ha]) as the difference in soil carbon stocks multiplied by the atomic weight of CO_2 and divided by the atomic weight of C.

Note that this is the total amount of CO_2 that has to be allocated to the individual crops and/or crop years after conversion, as detailed in the ILCD general handbook .

At the end of the tables some example calculations are given.

Table 7: Native soil carbon stocks under native vegetation (tonnes C ha-1 in upper 30 cm of soil) (IPCC 2006)

Climate Region	High activity clay soils	Low activity clay soils	Sandy soils	Spodic soils	Volcanic soils	Wetland soils
Boreal	68	NA	10	117	20	146
Cold temperate, dry	50	33	34	NA	20	97
Cold temperate, moist	95	85	71	115	130	
Warm temperate, dry	38	24	19	NA	70	88
Warm temperate, moist	88	63	34	NA	80	
Tropical, dry	38	35	31	NA	50	86
Tropical, moist	65	47	39	NA	70	
Tropical, wet	44	60	66	NA	130	
Tropical montane	88	63	34	NA	80	

Table 8: Land use factors (IPCC 2006)

Land-use	Temperature regime	Moisture regime	Land use factors (IPCC default)	Error (±)[18]
Long-term cultivated	**Temperate/Boreal**	**Dry**	0.80	9 %
		Moist	0.69	12 %
	Tropical	**Dry**	0.58	61 %
		Moist/Wet	0.48	46 %

[18] Error = two standard deviations, expressed as a percent of the mean; where sufficient studies were not available for a statistical analysis a default, a value based on expert judgment (40 %, 50%, or 90%) is used as a measure of the error. NA denotes 'Not Applicable', for factor values that constitute reference values or nominal practices for the input or management classes. This error range does not include potential systematic error due to small sample sizes that may not be representative of the true impact for all regions of the world.

	Tropical montane	**n/a**	0.64	50 %
Permanent grassland	**All**		1.00	
Paddy rice	**All**	**Dry and Moist/Wet**	1.10	50 %
Perennial/Tree Crop	**All**		1.00	50 %
Set-aside (< 20 yrs)	**Temperate/Boreal and Tropical**	**Dry**	0.93	11 %
		Moist/Wet	0.82	17 %
	Tropical montane	**n/a**	0.88	9

Table 9: Land management and input level factors for cropland (IPCC 2006)

Land management (for cultivated land only)				
Land-use management	**Temperature regime**	**Moisture regime**	**Land management and input level factors (IPCC defaults)**	**Error (±)**[225]
Full tillage	**All**	**Dry and Moist/Wet**	1.00	NA
Reduced tillage	**Temperate/Boreal**	**Dry**	1.02	6 %
		Moist	1.08	5 %
	Tropical	**Dry**	1.09	9 %
		Moist/Wet	1.15	8 %
	Tropical montane	**n/a**	1.09	50 %
No tillage	**Temperate/Boreal**	**Dry**	1.10	5 %
		Moist	1.15	4 %
	Tropical	**Dry**	1.17	8 %
		Moist/Wet	1.22	7 %
	Tropical montane	**n/a**	1.16	50 %
Input level (for cultivated land only)				
Low input	**Temperate/Boreal**	**Dry**	0.95	13 %
		Moist	0.92	14 %
	Tropical	**Dry**	0.95	13 %

		Moist/Wet	0.92	14 %
	Tropical montane	**n/a**	0.94	50 %
Medium input	**All**	**Dry and Moist/Wet**	1.00	NA
High input without manure	**Temperate/Boreal and Tropical**	**Dry**	1.04	13 %
		Moist/Wet	1.11	10 %
	Tropical montane	**n/a**	1.08	50 %
High input with manure	**Temperate/Boreal and Tropical**	**Dry**	1.37	12 %
		Moist/Wet	1.44	13 %
	Tropical montane	**n/a**	1.41	

Table 10: Land management and input level factors for grassland (IPCC 2006)

Land management (for grassland only)			
Land-use management	**Temperature regime**	**Land management and input level factors (IPCC defaults)**	**Error (±)**[225]
Nominally managed (non-degraded)	**All**	1.00	NA
Moderately degraded	**Temperate/Boreal**	0.95	13 %
	Tropical	0.97	11 %
	Tropical Montane	0.96	40 %
Severely degraded	**All**	0.70	40 %
Improved grassland	**Temperate/Boreal**	1.14	11 %
	Tropical	1.17	9 %
	Tropical Montane	1.16	40 %
Input level (for improved grass land only)			
Medium	**All**	1.00	NA
High	**All**	1.11	7 %

In order to calculate the annual changes in carbon stocks due to land-use change, please refer to the following three illustrative examples[19]:

Example 1: Transformation of "set-aside land" in the UK for "annual crop production"

Aspects:

- Climate Region of UK: Cold temperature
- Moisture Regime of UK: Moist
- Soil type (typical, average, or specific, e.g. this might be): High activity clay soils

--> *SOCn* = 95 t/ha (Table 7)

- Land use 1 (before transformation): Set-aside land (< 20 yrs)

--> *LUF1* = 0.82 (Table 8)

- Land use 2 (after transformation): Long-term cultivated crop land

--> *LUF2* = 0.69 (Table 8)

- Land management of land use 1: none (as land use is "set-aside land")

--> *LMF1* = 1[20]

- Input factor land use 1: none (as land use is "set-aside land")

--> *IF1* = 1

- Land management of land use 2: Full tillage

--> *LUF2* = 1.00 (Table 9)

- Input factor land use 2: High input without manure

--> *IF2* = 1.11 (Table 9)

Factors from the tables and calculations:

- Original carbon stock of land use 1= 95 * 0.82 * 1 * 1 = 77.9 tonnes of Carbon per ha
- Final carbon stock of land use 2= 95 * 0.69 * 1.00 * 1.11 = 72.8 tonnes of Carbon per ha
- Loss in carbon stock = 5.1 tonnes of Carbon per ha

Resulting annual CO_2 emissions to be attributed to that "annual crop" over the applicable entire time period of use (20 years) = 5.1 * 44 / 12 = 18.7 tonnes of CO_2 emissions per ha[21,22].

[19] Note: The climate regions, soil types, temperature and moisture regimes, as well and the land use and management adopted in all these examples is for illustrative purposes only.

[20] For no use of the land (i.e. fallow, natural forest, etc.), the land management factor and the input factor are both always = 1; these values are not given in the table that only lists factors for managed land (i.e. cropland and grassland).

[21] The numbers are given per ha (10,000 m2) and need to be converted to the e.g. kg of harvested crop.

[22] These numbers are of course to be complemented with other GHG etc. emissions from machine operation, fertiliser production, etc.

Example 2: Transformation of forest in Indonesia for annual crop production

- Climate Region of Indonesia: Tropical
- Moisture Regime of Indonesia: wet
- Soil type: Volcanic
- Land use 1: Native
- Land use 2: Long-term cultivated
- Land management and input level of land use 1: none
- Land management and input level of land use 2: Reduced tillage, low input

- Original carbon stock of land use 1= 130 * 1.00 * 1 * 1 = 130 tonnes of Carbon per ha
- Final carbon stock of land use 2 = 130 * 0.48 * 1.15 * 0.92 = 66.0 tonnes of Carbon per ha
- Loss in carbon stock = 64.0 tonnes of Carbon per ha[23]

Resulting annual CO_2 emissions to be attributed to that "annual crop" over the applicable entire time period of use (20 years) = 64 * 44 / 12 = 234.67 tonnes of CO_2 emissions per ha.

Example 3: Transformation of grassland in Canada for annual crop production

- Climate Region of Canada: Cold temperate
- Moisture Regime of Canada: dry
- Soil type: Sandy soils
- Land use 1: Permanent grassland
- Land use 2: Long-term cultivated
- Land management and input level of land use 1: Nominally managed (non-degraded), medium input
- Land management and input level of land use 2: Full tillage, high input with manure

- Original carbon stock of land use 1 = 34 * 1.00 * 1.00 * 1.00= 34 tonnes of Carbon per ha
- Final carbon stock of land use 2 = 34 * 0.80 * 1.00 * 1.37 = 37.3 tonnes of Carbon per ha
- Loss in carbon stock = -3.3[24] tonnes of Carbon per ha

Resulting annual CO2 emissions to be attributed to that "annual crop" over the applicable entire time period of use (20 years) = -3.3 * 44 / 12 = -12.1 tonnes of CO2 emissions per ha, i.e. 12.1 tonnes of CO2 accumulation / binding as soil organic carbon.

[23] Note that the Carbon bound in the biomass (i.e. trees) of the natural tropical forest is several times higher.
[24] Negative loss, i.e. an accumulation

This last example illustrates a land transformation that results in net carbon storage in the soil. Please note that, even though this crop is credited for sequestering carbon dioxide from the atmosphere to the soil, the temporary nature of this storage may need to be considered in the results interpretation.

(INFORMATIVE)

Annex II. Data Management Plan (adapted from GHG protocol initiative[25])

If a data management plan is developed, the following steps should be undertaken and documented.

1. ***Establish an Organisation accounting quality person/team***. This person/team should be responsible for implementing and maintaining the data management plan, continually improving the quality of Organisation inventories, and coordinating internal data exchanges and any external interactions (such as with relevant Organisation accounting programs and reviewers).

2. ***Develop Data Management Plan and Checklist***. Development of the data management plan should begin before any data is collected to ensure all relevant information about the inventory is documented as it proceeds. The plan should evolve over time as data collection and processes are refined. In the plan, the quality criteria and any evaluation/scoring systems are to be defined. The data management plan checklist outlines what components should be included in a data management plan and can be used as a guide for creating a plan or for pulling together existing documents to constitute the plan.

3. ***Identify relevant processes***. Generic data shall be used to identify relevant processes. Checks should be performed on all processes in the system within the selected system boundaries.

4. ***Perform data quality checks***. Checks should be applied to all aspects of the inventory process, focusing on data quality, data handling, documentation, and calculation procedures. The defined quality criteria and scoring systems form the basis for the data quality checks.

5. ***Review final of Organisation inventory and reports***. Selected independent external reviewers should review the study – ideally from the beginning.

6. ***Establish formal feedback loops to improve data collection, handling and documentation processes***. Feedback loops are needed to improve the quality of the Organisation inventory over time and to correct any errors or inconsistencies identified in the review process.

7. ***Establish reporting, documentation and archiving procedures***. Establish record-keeping processes for what data should be stored and how they should be stored; what information should be reported as part of internal and external inventory reports; and what should be documented to support data collection and calculation methodologies. The process may also involve aligning or developing relevant database systems for record keeping.

The data management plan is likely to be an evolving document that is updated as data sources change, data handling procedures are refined, calculation methodologies improve, Organisation inventory responsibilities change within an organisation, or the business objectives of the Organisation inventory change.

Data collection template

[25] GHG protocol initiative, 2010): Product accounting and Reporting standard (draft as of Jan 2011)…..

A data collection template is useful for organizing data collection activities and results while compiling the Resource Use and Emissions Profile. A data collection template may include the following aspects:

- Introduction to the Organisation Environmental Footprint study, including an overview of the objectives of data collection and the template/questionnaire employed;
- Information on the entity(ies) or person(s) responsible for measurement and data collection procedures;
- Description of the site where data is to be collected (for example, maximum and normal operation capacity, annual productive output, location, number of employees, etc.);
- Date/year of data collection;
- Description of the Organisation;
- Product/Service Portfolio description;
- Overall technical flow diagrams for owned/operated facilities within defined organisational boundaries;
- Input and outputs per facility;

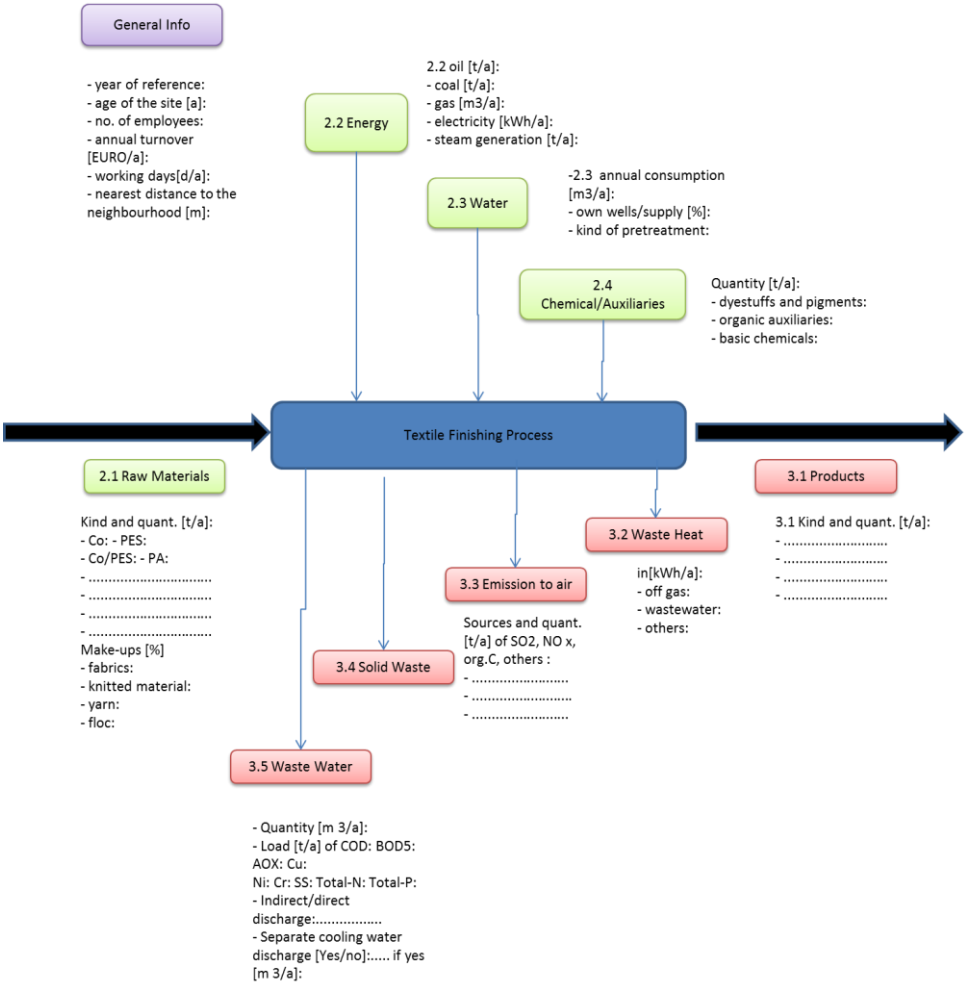


Figure 6: Technical flow diagram for a facility within the defined organisational boundary

Total Inputs to Facility

Code	Name	Amount	Unit

Total Outputs from Facility

Code	Name	Amount	Unit

Example of Resource Use and Emissions Profile data inventory for a facility (selected substances)

Parameter	Unit	
Energy consumption	GJ	115.5
Electricity	GJ	34.6
Fossil Fuel	GJ	76
Natural gas	Mg	0.59
Natural gas, feedstock	Mg	0.16
Crude oil	Mg	0.57
Crude oil, feedstock	Mg	0.48
Coal	Mg	0.66
Coal, feedstock	Mg	0.21
LPG	Mg	0.02
Hydro power	GJ	5.2
Water	Mg	12400
Emissions to air		
CO2	Mg	5,132
CH4	Mg	8.2
SO2	Mg	3.9
Nox	Mg	26.8
CH	Mg	25.8
CO	Mg	28
Emissions to water		
COD Mn	Mg	13.3
BOD	Mg	5.7
Tot-P	Mg	0.052
Tot-N	Mg	0.002
Product Outputs		
Pants	#	20,000
T-Shirts	#	15,000

Annex III Dealing with Multi-functionality in recycling situations

Dealing with multi-functionality of products is particularly challenging when recycling or energy recovery of one (or more) of these products is involved as the systems tend to get rather complex.

The “Recycling rate method” is to be used for this purpose for the calculation of PEF. This method is also referred to as the "end-of-life recycling" approach, or the "recyclability substitution” approach. The overall resulting emissions (per unit of analysis) including the entire waste management of the product to be recycled can be estimated using material recycling. Likewise, the overall resulting emissions (per unit of analysis) including the entire waste management in case energy recovery is involved can be estimated using the formula for energy recovery.

For multi-functionality issues involving only material recycling

Primary Production Disposal Recycling Credits or Debits

$$\text{Overall emissions (per kg of material)} = \underbrace{EP*Cp}_{\text{Primary Production}} + \underbrace{ED*(1-Rm)}_{\text{Disposal}} + \underbrace{(ER*Rm)}_{\text{Recycling}} - \underbrace{(Rm-Cr)*(EP*(Qs/Qp))}_{\text{Credits or Debits}}$$

Where:

Assuming that the material from the recycling process has the same inherent properties (although it may have a different quality level) as the primary material.

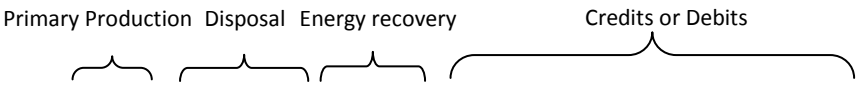
- EP = emissions (per kg of material) arising from primary production
- Cp = “content, primary” is the proportion of primary material that is used in the initial production
- ER = emissions (per kg of recycled output) arising from the recycling processing
- Cr = “content, recycled” is the proportion of recycled material that is used in the initial production (Cr = 1 – Cp)
- ED = emissions (per kg of waste) arising from disposal of waste material
- Rm = “recycling rate of material” is the proportion of material in the product that will be recycled in a subsequent system. Rm must take into account the inefficiencies in the collection and recycling processes (i.e. Rm=<1)
- Qs = quality of the secondary material
- Qp = quality of the primary material

This formula can be divided into four blocks which are interpreted as follows:

- Primary production = EP*Cp represents the emissions from primary production
- Disposal = ED*(1-Rm) represents the emissions from disposal of waste, taking into account the proportion of the material in the product that is not recycled at end-of-life (1-Rm)

  Note* if the amount material input to the recycling process (Rin) is known, replace Rm with Rin
- Recycling = ER*Rm represents the emissions from the recycling process including all related activities (e.g. transport and waste treatment processes), which is proportional to the share of material that is recycled into secondary material at end-of-life (Rm)
- Credits or Debits = (Rm-Cr)*(EP*(Qs/Qp) represents the credits (i.e. avoided emissions) for the replaced material, taking into account the quality correction ratio. This ratio is taken as an approximation for any differences in quality between the secondary material and the primary material. Following the environmental footprint multi-functionality hierarchy, it shall first be considered whether a relevant, underlying physical relationship can be identified as a basis for the quality correction ratio. If this is not possible some other relationship shall be used - for example, economic value. Here, prices of primary versus secondary materials are assumed to provide a proxy for quality. In this case, Qs/Qp would be the ratio between the market price of the secondary material (Qs) and the market price of the primary material (Qp).

For multi-functionality issues involving only energy recovery



Overall emissions (per kg) = EP*Cp + ED*(1-Re) + EER *Re – Re*LCV*NEE*Ee-(Cr*EP*(Qs/Qp))

Where:

- EP = emissions (per unit of analysis) arising from primary production
- Cp = “content, primary” is the proportion of primary material that is used in the initial production
- ER = emissions (per unit of analysis) arising from the processing of recycled material output for use in a subsequent product system
- ED = emissions (per kg of waste material) arising from disposal of waste material by means other than for energy recovery
- Re = “rate for energy recovery” is the proportion of material in the product that is assumed to be used for energy recovery at end-of-life. Re must take into account the inefficiencies in the collection processes (i.e. Re=<1)
- EER = emissions (per kg incinerated material) arising from the energy recovery process

- Ee = emissions (per MJ) arising from the (assumed) substituted form of energy production
- Cr = "content, recycled" is the proportion of recycled material that is used in the initial production
- LCV = lower calorific value
- NEE = Energy efficiency of the recovery processes
- Qs = quality of the secondary material

  Qp = quality of the primary material

This formula can be divided into four blocks which are interpreted as follows:

- Primary production = EP*Cp represents the emissions from primary production and from the processing of recycled material, taking into account the recycled content on the input side
- Disposal = ED*(1-Re) represents the emissions from disposal of waste, thus taking into account the proportion of the material in the product that is not used for energy recovery at end-of-life (1-Re)
- Energy recovery = EER*Re represents the emissions from the energy recovery process, proportional to the share of material that is used for energy recovery at end-of-life (Re)
- Credits or Debits = Re*(calorific Value)*NEE*Ee-(Cr*EP*(Qs/Qp)) represents the credits (avoided emissions) from the energy production that is assumed to be substituted by the recovered energy (including emissions related to the primary material used to produce the substituted energy). The ratio Qs/Qp is taken as an approximation for any differences in quality between the secondary material and the primary material. Following the environmental footprint multi-functionality hierarchy, it shall first be considered whether a relevant, underlying physical relationship can be identified as a basis for the quality correction ratio. If this is not possible some other relationship shall be used - for example, economic value. Here, prices of primary versus secondary materials are assumed to provide a proxy for quality. In this case, Qs/Qp would be the ratio between the market price of the secondary material (Qs) and the market price of the primary material (Qp).

To use the above formula for material, the (end-of-life) recycling rate (Rm) should be known. The following table (Table 11), based on statistics from Eurostat[26,27,28], provides default recycling rate values for a number of selected streams of packaging waste (reference year: 2008). These shall be intended as purely indicative values, which may be used as default only if specific, high quality data are not available. Figure 7 provides recycling rates for packaging waste (i.e. all packaging waste streams included) in the EU-27 Member States (reference year: 2007) [29]. Table 12 provides suggested default recycling rates for metals[30]. Comprehensive

[26] Eurostat: http://epp.eurostat.ec.europa.eu/portal/page/portal/environment/data/main_tables
[27] Eurostat 2010 report "Environmental statistics and accounts in Europe"; ISBN 978-92-79-15701-1; available online at http://epp.eurostat.ec.europa.eu/portal/page/portal/environment/introduction
[28] Eurostat - Environmental Data Center on Waste;
http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/wastemanagement/recycling
[29] Eurostat - Environmental Data Center on Waste;
http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/wastemanagement/recycling

statistics on waste recycling rates can be found in the above referenced sources from Eurostat. Table 13 and Table 14 provide examples of primary and secondary materials' prices, respectively.

[30] Based on the International Resource Panel: Appendix C and Appendix E of "Recycling Rates of Metals: a status report" ISBN: 978-92-807-3161-3

Table 11: Suggested default recycling rates for selected streams of packaging waste (Eurostat, 2008)

Country	Overall packaging waste	Plastic packaging	Paper & Cardboard packaging	Metal packaging	Wooden packaging	Glass packaging
Belgium	78.9	39.5	89.4	94.0	57.9	100
Bulgaria	50.3	15.6	84.9	65.1	40.6	47
Czech Republic	67.1	50.2	93.8	42.9	29.3	69.9
Denmark	59.7	25.4	61.0	81.9	41.0	120.9
Germany	70.5	47.3	87.7	91.7	28.8	82.2
Estonia	43.5	22.0	65.1	25.6	56.7	45.8
Ireland	61.7	28.9	78.2	62.0	76.7	73.9
Greece	43.8	11.9	73.6	43.8	30.8	15
Spain	59.1	24.4	73.4	67.8	58.2	60
France	55.2	22.5	86.9	60.2	18.9	62.7
Italy	59.6	31.1	73.8	68.4	53.1	65
Cyprus	34	14.8	59.9	94.9	14.9	17.7
Latvia	46.8	17.6	66.1	68.1	28.3	53
Lithuania	51.7	32.6	73.0	62.1	43.4	49.9
Luxemburg	63.6	29.7	77.6	79.4	19.2	92.2
Hungary	50.8	25.1	90.6	66.9	22.6	27.8
Netherlands	72.4	36.4	96.4	86.3	36.1	87
Austria	67.9	34.9	85.4	63.9	21.9	84.3
Poland	42.9	23.9	67.1	37.5	26.3	43.8
Portugal	61.0	19.1	87.8	64.8	64.5	51.8
Romania	33.5	15.5	61.6	51.0	8.3	34.7
Slovenia	52.4	55.6	66.4	21.4	7.2	79.8
Slovakia	47.7	43.7	53.6	55.8	16.1	47.6
Finland	56.7	22.7	93.1	75.4	21.3	79.8
Sweden	58.5	37.0	74.1	71.3	16.7	93.5
United Kingdom	61.5	23.7	79.7	56.9	76.5	61.3

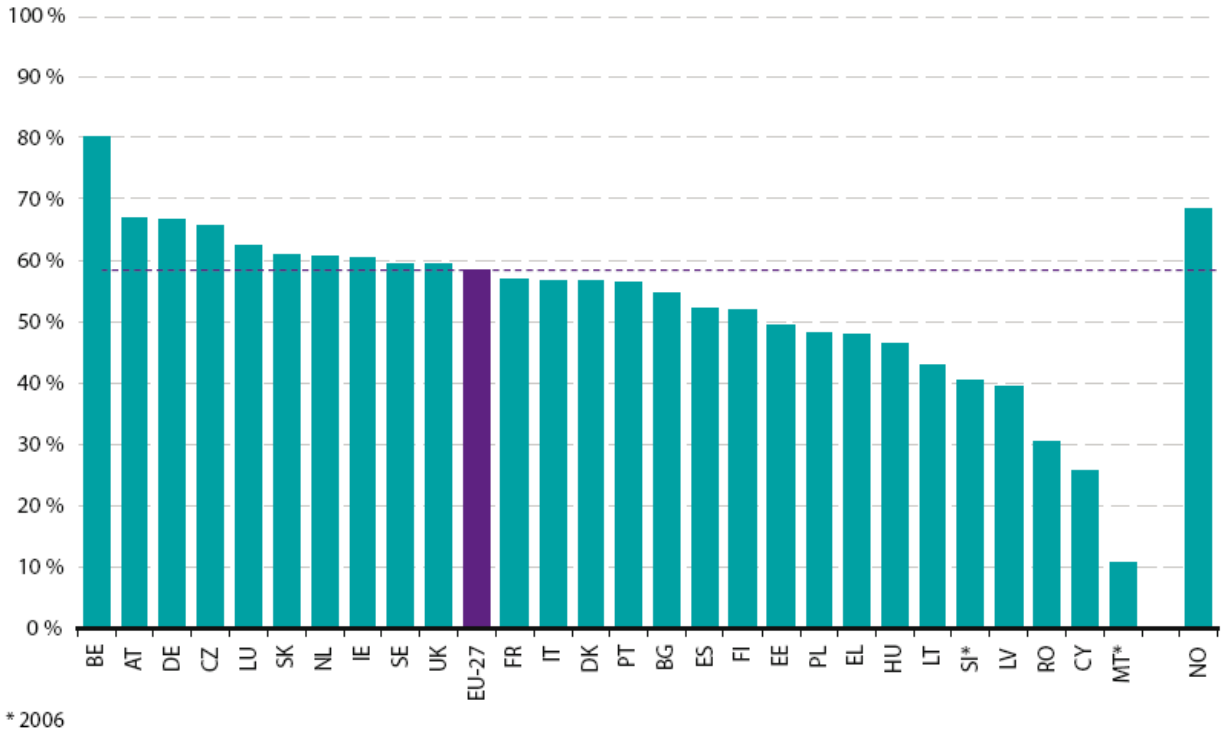


Figure 7: Packaging waste recycling rates in EU-27 Member States (year 2007)

Table 12: suggested default recycling rates for metals

Metal	Recycling Rate (R)	Metal	Recycling Rate (R)
Cr	90%	Mg	39%
Mn	53%	Al	57%
Fe	72%	Ti	91%
Ni	59%	Co	68%
Nb	53%	Cu	48%
Mo	30%	Zn	40%
V	1%	Sn	75%
Ru	10%	Pb	72%
Rh	55%	Pt	71%
Pd	65%	Au	51%
Ag	65%	Os	1%

Table 13: Primary material price

World Bank Commodity Price Data (Pink Sheet)

Annual Prices in Nominal and Real 2000 US dollars, 1960 to Present

(Annual series are available in nominal and real 2000 dollars; see column "BU" for real price series)

Updated as of: December 6, 2010

	Nominal US dollars																	Nominal US dollars		
																Steel	Steel	Steel	Steel	Steel
	Petroleum	Coal	Natural gas	Natural gas	Natural gas										Iron	Index	cold rolled	hot rolled		
	crude	Australian	US	Europe	Japan	Cocoa	Aluminum	Copper	Lead	Tin	Nickel	Zinc	Gold	Silver	ore	Japan	coilsheet	coilsheet	rebar	wire rod
	($/bbl)	($/mt)	($/mmbtu)	($/mmbtu)	($/mmbtu)	(cents/kg)	($/mt)	($/mt)	(cents/kg)	(cents/kg)	($/mt)	(cents/kg)	($/toz)	(cents/toz	($/mt fe)	(2000=100	($/mt)	($/mt)	($/mt)	($/mt)
1980	36.87	40.14	1.55	4.22	5.70	260.35	1456.00	2182.00	90.60	1677.49	6518.70	76.10	607.90	2063.60	28.09	108.74	386.08	323.33	330.83	350.83
1981	35.48	53.62	1.93	4.60	6.03	207.96	1263.00	1741.90	72.70	1415.91	5953.10	84.60	459.75	1051.80	28.09	111.43	399.67	328.83	313.33	387.50
1982	32.65	54.77	2.40	4.45	6.05	173.56	992.00	1480.40	54.60	1282.58	4837.50	74.50	375.80	794.70	32.50	95.27	367.92	281.67	242.50	353.33
1983	29.66	38.19	2.53	4.05	5.55	211.99	1439.00	1591.90	42.50	1298.80	4672.80	76.40	422.53	1144.10	29.00	89.02	360.42	270.00	222.50	312.50
1984	28.56	30.96	2.59	3.80	5.24	239.60	1251.00	1377.30	44.30	1223.35	4752.30	92.20	360.47	814.10	26.15	93.70	376.67	283.83	233.33	308.75
1985	27.18	33.75	2.45	3.70	5.23	225.45	1041.00	1417.40	39.10	1153.90	4899.10	78.30	317.91	614.20	26.56	80.96	326.25	245.83	225.42	272.92
1986	14.35	31.13	1.89	2.90	4.10	206.97	1150.00	1373.80	40.60	616.14	3881.20	75.40	364.17	547.00	26.26	82.49	325.42	269.58	219.58	239.58
1987	18.15	27.50	1.62	2.15	3.35	199.42	1565.00	1782.50	59.70	666.48	4872.20	79.90	446.47	701.00	25.30	95.86	385.42	323.33	202.92	248.33
1988	14.72	34.88	1.64	2.00	3.34	158.46	2551.00	2601.70	65.60	705.16	13778.30	124.10	437.05	654.00	24.30	125.30	501.25	395.83	262.50	313.75
1989	17.84	38.00	1.70	2.10	3.28	124.10	1951.00	2848.40	67.30	853.44	13308.20	165.90	381.43	550.00	27.83	140.08	550.42	441.92	341.67	350.83
1990	22.88	39.67	1.70	2.55	3.64	126.67	1639.00	2661.50	81.10	608.54	8864.10	151.30	383.47	488.83	32.50	134.43	511.25	411.25	364.17	362.92
1991	19.37	39.67	1.49	3.11	3.99	119.51	1302.20	2338.80	55.80	559.50	8155.60	111.70	362.18	404.14	34.76	131.86	504.17	408.33	367.08	383.33
1992	19.02	38.56	1.77	2.56	3.60	109.96	1254.30	2281.15	54.10	610.10	7001.23	124.00	343.73	393.60	33.10	116.48	469.17	369.17	306.67	372.50
1993	16.84	31.33	2.12	2.67	3.51	111.69	1139.05	1913.08	40.64	516.11	5293.42	96.20	359.77	429.84	29.09	122.67	470.00	375.83	348.75	395.83
1994	15.89	32.30	1.92	2.44	3.18	139.60	1476.78	2307.42	54.78	546.38	6339.82	99.77	384.01	528.42	26.47	122.59	511.67	402.92	322.50	371.67
1995	17.18	39.37	1.72	2.73	3.45	143.24	1805.65	2935.61	63.10	621.38	8228.04	103.11	384.16	519.18	28.38	141.87	554.17	440.83	381.67	420.83
1996	20.42	38.07	2.73	2.84	3.67	145.56	1505.66	2294.86	77.43	616.51	7500.82	102.51	387.70	518.34	30.00	128.42	483.92	365.58	360.17	438.50
1997	19.17	35.10	2.48	2.74	3.91	161.87	1599.33	2276.77	62.42	564.68	6927.39	131.61	331.10	489.22	30.15	117.94	448.17	337.25	325.17	382.67
1998	13.07	29.23	2.09	2.42	3.02	167.64	1357.47	1654.06	52.86	554.03	4629.52	102.45	294.16	553.43	31.00	98.44	370.83	279.17	257.50	332.08
1999	18.07	25.89	2.27	2.13	3.14	113.53	1361.09	1572.86	50.26	540.36	6011.23	107.63	278.77	524.95	27.59	89.09	340.42	243.33	234.17	290.00
2000	28.23	26.25	4.31	3.86	4.71	90.58	1549.14	1813.47	45.39	543.57	8637.74	112.81	279.03	499.92	28.79	100.00	385.83	295.83	244.17	291.67
2001	24.35	32.31	3.96	4.06	4.63	106.87	1443.63	1578.29	47.62	448.44	5944.73	88.58	270.99	438.61	30.03	86.93	299.15	216.52	221.46	302.29
2002	24.93	25.31	3.36	3.05	4.28	177.79	1349.92	1559.48	45.27	406.05	6771.75	77.88	309.97	462.52	29.31	88.21	328.33	246.67	204.17	300.00
2003	28.90	26.09	5.49	3.91	4.73	175.09	1431.29	1779.14	51.50	489.49	9629.47	82.77	363.51	491.07	31.95	103.31	444.58	320.21	265.83	300.00
2004	37.73	52.95	5.90	4.28	5.13	154.99	1715.54	2865.88	88.65	851.27	13823.24	104.78	409.21	669.05	37.90	168.19	607.08	502.50	428.75	487.50
2005	53.39	47.62	8.92	6.33	5.99	153.81	1898.31	3678.88	97.64	737.98	14743.96	138.13	444.84	733.81	65.00	186.80	733.33	633.33	423.13	579.17
2006	64.29	49.09	6.72	8.47	7.08	159.19	2569.90	6722.13	128.97	878.08	24254.41	327.53	604.34	1156.91	77.35	181.62	693.75	600.00	443.75	581.25
2007	71.12	65.73	6.98	8.56	7.68	195.23	2638.18	7118.23	258.00	1453.68	37229.81	324.24	696.72	1341.25	84.70	181.97	650.00	550.00	521.50	533.33
2008	96.99	127.10	8.86	13.41	12.55	257.71	2572.79	6955.88	209.07	1851.01	21110.64	187.47	871.71	1499.90	140.60	289.33	965.63	883.33	760.17	1009.75
2009	61.76	71.84	3.95	8.71	8.94	288.92	1664.83	5149.74	171.93	1357.39	14654.63	165.51	972.97	1469.41	100.95	227.05	783.33	683.33	486.04	969.42

Table 14: Secondary material price

Material	Secondary material price per kg
Al	1.45
Cu	1.67
Zn	2.32
Au	9653.23
Ag	166.55
Ni	7.84
Steel	0.29
Sn	-
PET	1.15
Paper	0.14
Glass	-
HDPE	0.93
PP	
Stainless steel	

Ref: (Analysis of National Solid Waste Recycling Programs, 1999; Financial Times, 2000; American Metal Market, 1999; US Geological Survey, 1997–2000)

(INFORMATIVE)

Annex IV Identifying Appropriate Nomenclature and Properties for Specific Flows

Required rules for each flow type.

Items	Rule from the ILCD- Nomenclature[31]
Raw material, input	2, 4, 5
Emission, output	2,4,9
Product flow	10,11,13,14,15,16,17

ILCD Nomenclature Rules[32].

Rule #	Rule Category	Rule/ Required Nomenclature
1	Requirement status of the individual rules	For ILCD-compliant LCI data sets, LCA studies and other ILCD-compliant deliverables the "mandatory" rules shall always be met, while the “recommended” ones are only recommended.
CLASSIFICATION/CATEGORIZATION OF FLOWS		
CLASSIFICATION/CHARACTERISATION OF ELEMENTARY FLOWS		
Classification / categorisation according to (sub)compartment of receiving / providing environment		
2	"elementary flow categories" by receiving / providing environmental compartment	Resources - Resources from ground Resources - Resources from water Resources - Resources from air Resources – Resources from biosphere Land use – Land transformation Land use – Land occupation Emissions – Emissions to air - Emissions to air,

[31] ILCD Handbook – Nomenclature and other conventions. Available online at http://lct.jrc.ec.europa.eu/assessment/publications
[32] Same as previous footnote

Rule #	Rule Category	Rule/ Required Nomenclature
		unspecified Emissions – Emissions to air - Emissions to air, unspecified (long-term) Emissions – Emissions to air - Emissions to urban air close to ground Emissions – Emissions to air - Emissions to non-urban air or from high stacks Emissions – Emissions to air - Emissions to lower stratosphere and upper troposphere Emissions – Emissions to water - Emissions to water, unspecified Emissions – Emissions to water - Emissions to water, unspecified (long-term) Emissions – Emissions to water - Emissions to fresh water Emissions – Emissions to water - Emissions to sea water Emissions – Emissions to soil - Emissions to soil, unspecified Emissions – Emissions to soil - Emissions to agricultural soil Emissions – Emissions to soil - Emissions to non-agricultural soil Emissions – Emissions to soil - Emissions to soil, unspecified (long-term) Other elementary flows
3	Splitting emissions to brackish water	If an emission into brackish water appears, the amount of emissions should be split into a 50% share of emission to seawater and 50% to freshwater.
Discussion of a possible further differentiation of receiving / providing environment		
4	Further differentiation of providing/receiving environmental compartments	Further differentiated receiving / providing environmental compartments below the compartments defined more above shall presently not be used.

Rule #	Rule Category	Rule/ Required Nomenclature
Classification according to substance-type of elementary flow		
Substance-type based classification for resources		
5	Additional, non-identifying classification for "Resources from ground" elementary flows	"Non-renewable material resources from ground" (e.g. "Sand", "Anhydrite; 100%", etc.) "Non-renewable element resources from ground " (e.g. "Gold", "Copper", etc.) "Non-renewable energy resources from ground " (e.g. "Hard coal; 32.7 MJ/kg net calorific value", "Uranium; natural isotope mix; 451000 MJ/kg", etc.) "Renewable element resources from ground " (e.g. "Radon", etc.) "Renewable energy resources from ground" (e.g. "Wind energy", "Water energy; running", etc.) "Renewable material resources from ground" "Renewable resources from ground, unspecified" (for renewable resource elementary flows from ground that do not fit into any of the other categories) "Non-renewable resources from ground, unspecified" (for non-renewable resource elementary flows from ground that do not fit into any of the other categories)
6	Additional, non-identifying classification of "Resources from water" elementary flows	"Non-renewable element resources from water" (e.g. Magnesium, Bromium, Hydrogen etc.) "Non-renewable material resources from water" "Non-renewable energy resources from water" "Renewable element resources from water" "Renewable material resources from water " (e.g. "Groundwater, etc) "Renewable energy resources from water" (e.g. "Hydro energy; running", "Tidal energy", etc.) "Renewable resources from water, unspecified" (for renewable resource elementary flows from water that do not fit into any of the other categories)

Rule #	Rule Category	Rule/ Required Nomenclature
		"Non-renewable resources from water, unspecified" (for non-renewable resource elementary flows from water that do not fit into any of the other categories)
7	Additional, non-identifying classification of "Resources from air" elementary flows	"Non-renewable material resources from air" "Non-renewable element resources from air" "Non-renewable energy resources from air" "Renewable element resources from air" (e.g. "Oxygen", "Argon", etc.) "Renewable energy resources from air" (e.g. Wind energy, solar energy, etc.) "Renewable material resources from air" "Renewable resources from air, unspecified" (for renewable resource elementary flows from air that do not fit into any of the other categories) "Non-renewable resources from air, unspecified" (for non-renewable resource elementary flows from air that do not fit into any of the other categories)
8	Additional, non-identifying classification of resource elementary flows (for use as sub-classification for the "Resources from biosphere" top class	"Renewable genetic resources from biosphere" (for extraction/hunting of wild species e.g. "Mahagony wood (Tectona grandis), without bark; standing; primary forest") "Renewable material resources from biosphere" (e.g. "Round soft wood; 50% H2O") "Renewable energy resources from biosphere" (e.g. "Wood biomass; 50% H2O, 7.2 MJ/kg") "Renewable element resources from biosphere" "Renewable resources from biosphere, unspecified" (for renewable resource elementary flows from biosphere that do not fit into any of the other categories)
Substance-type based classification for emissions		
9	Recommended for both technical and non-technical target audience: additional, non-identifying classification for	"Metal and semimetal elements and ions" (e.g., "Arsenic", "Cadmium", "Chromium, III", etc.) "Non-metallic or -semimetallic ions" (e.g.

Rule #	Rule Category	Rule/ Required Nomenclature
	emissions	"Ammonium", "Phosphate", etc.) "Inorganic covalent compounds" (e.g. "Carbon dioxide, fossil", "Carbon monoxide", "Sulphur dioxide", "Ammonia", etc.) "Cyclic organics" (e.g. "Hexachloro-benzene", "Cyclopentane", "Naphthalene", etc.) "Acyclic organics" (e.g. "Ethene", "3-methyl-1-butene", "1,2-chloro-pentane" etc.) "Pesticides" (e.g. "Chlorfenvinphos", "Tributyl-tin" etc.) "Radioactives" (e.g. "Cesium-137", "Radon-220", etc.) "Particles" (e.g. "PM <2.5µm", "PM 2.5-10µm", etc.) "Other substance type"
HIERARCHICAL CLASSIFICATION OF PRODUCT FLOWS, WASTE FLOWS, AND PROCESSES		
10	Top-level classification for Product flows, Waste flows, and Processes	"Energy carriers and technologies" "Materials production" "Systems" "End-of-life treatment" "Transport services" "Use and consumption" "Other services"
11	Second level classifications for Product flows, Waste flows, and Processes (for preceding top-level classification)	"Energy carriers and technologies" "Energetic raw materials" (Note: this refers to the extracted products and related technologies, not the resources e.g. in the ground) "Electricity" "Heat and steam" "Mechanical energy" "Hard coal based fuels"

Rule #	Rule Category	Rule/ Required Nomenclature
		"Lignite based fuels" "Crude oil based fuels" “Natural gas based fuels” "Nuclear fuels" "Other non-renewable fuels" "Renewable fuels" “Materials production” “Non-energetic raw materials” (Note: this refers to the extracted products and related technologies, not the resources e.g. in the ground) "Metals and semimetals" "Organic chemicals" "Inorganic chemicals" "Glass and ceramics" "Other mineral materials" "Plastics" "Paper and cardboards" "Water" "Agricultural production means" “Food and renewable raw materials" "Wood" "Other materials" “Systems" "Packaging" "Electrics and electronics" "Vehicles"

Rule #	Rule Category	Rule/ Required Nomenclature
		"Other machines" "Construction" "White goods" "Textiles, furniture and other interiors" "Unspecific parts" "Paints and chemical preparations" "Other systems" "End-of-life treatment" "Reuse or further use" "Material recycling" "Raw material recycling" “Energy recycling" "Landfilling" "Waste collection" "Waste water treatment" "Raw gas treatment" "Other end-of-life services" "Transport services" Road" Rail" Water" Air" Other transport" “Use and consumption" "Consumption of products" "Use of energy-using products"

Rule #	Rule Category	Rule/ Required Nomenclature
		"Other use and consumption" "Other Services" "Cleaning" "Storage" "Health, social services, beauty and wellness" "Repair and maintenance" "Sale and wholesale" "Communication and information services" “Financial, legal, and insurance” “Administration and government” “Defence” “Lodging and gastronomy” “Education” “Research and development” “Entertainment” “Renting” “Engineering and consulting” "Other services"
NOMENCLATURE FOR FLOWS AND PROCESSES		
STRUCTURING FLOW NAMES		
12	General flow and process naming rules	the entries within the same name component field should be listed separated by the character ",". Within the entries of the various name component fields the character ";" should be avoided abbreviations should be avoided in the base name field, unless these are very widely in use and complement the long name in the name field (e.g. do not use "PP" for "Polypropylene", but it can be added as "Polypropylene, PP") or chemical element symbols (e.g. do not use "Fe" for "Iron").

Rule #	Rule Category	Rule/ Required Nomenclature
		Chemical symbols can be used in the "Quantitative flow properties" field to indicate concentrations (e.g. "45% Fe" for an iron ore can be used). brackets within the field entries should be avoided
13	“Base name” field	Definition: "General descriptive name of the flow. Technical language should be used." Additional recommendations: The technical name should be given as it is used in the respective industry or towards their customers. For emissions the "base name" is the only one to be used; for certain resource flows also the last name component "quantitative flow properties" (see more below) is required, e.g. for energetic raw materials such as "Hard coal; 32.7 MJ/kg net calorific value". Recommendations for land use flows will depend on further developments in the LCIA area.
14	“Treatment, standards, routes” name field	Definition: "Qualitative information on the (product or waste) flow in technical term(s): treatment received, standard fulfilled, product quality, use information, production route name, educt name, primary / secondary etc. separated by commata." Additional recommendations and examples: Examples for types of terms that should be used preferably are: o For "treatment received": e.g. "polished", "cleaned", "chromium plated", "sterilised", etc. o For "standard fulfilled": technical standards such as for material grades/purity, fulfilled emission limits, etc. o For "product quality": other qualitative information such as e.g. "glossy", "UV-resistant", "flame-retardant", "antibacterial finishing", etc. o For "use information": e.g. "indoor use", "bottle grade", "for wafer production", etc. o For "production route name": process or production route used for producing this product, such as "suspension polymerisation", "spray dried", "Fischer-Tropsch", etc. o For "educt name": main in-going products ("educts") in case different routes exist may be needed, such as "from ore

Rule #	Rule Category	Rule/ Required Nomenclature
		roasting" for sulphuric acid, "pine wood" for timber, etc. (note that in practice often the educt is part of the commonly used base name, e.g. "Pine wood table"). o For "primary / secondary": "primary", "secondary"; for mixes with a fixed share of primary/secondary it should be enough to quantify the shares in the next name field on "Quantitative flow properties".
15	“Mix type and location type” name field	Definition: "Specifying information on the (product or waste) flow whether being a production mixture or consumption mix, location type of availability (such as e.g. "to consumer" or "at plant"), separated by commata." Additional recommendations and examples: o "Production mix" refers to the weighted average mix of production-routes of the represented product in the given geographical area and for the named technology (if any; otherwise overall average for all technologies). o "Consumption mix" is analogous i.e. including the weighted contribution of imported and exported products from/to outside the given geographical area, with the trade partners (e.g. countries) explicitly considered. Both apply both to goods and services. Entry is not required for technology-specific product flows or waste flows that do not depend on the geographical region. o For "location type of availability", the mainly required entries are: "at plant" (i.e. as/when leaving the production site), "at wholesale" (i.e. as/when leaving the wholesale storage), "at point-of-sale" (i.e. as/when leaving the point of sale to user), "to consumer" (i.e. including all transport, storage, wholesale and sale efforts and losses; consumer can be both private and business consumer). Further location types are possible and are to be named analogously. In case the point of entry to the wholesale / sale is to be named, the attribute "to" should be used, instead of the term "at" (e.g. "to wholesale" would include the transport efforts and losses until the good reaches the wholesale). Confusion with the intended use of a product/waste should be avoided, i.e. "at waste incineration plant", not "for waste incineration"; the latter would be a qualitative specifying property (as the waste may have received a dedicated pre-treatment etc.) and be put into the respective

Rule #	Rule Category	Rule/ Required Nomenclature
		name field “Treatment, standards, routes”.
16	“Quantitative flow properties” name field	Definition: "Further, quantitative specifying information on the (product or waste) flow, in technical term(s): qualifying constituent(s)-content and / or energy-content per unit, as appropriate. Separated by commata. (Note: non-qualifying flow properties, CAS No, Synonyms, Chemical formulas etc. are documented exclusively in the respective fields.)" Additional recommendations and examples: Examples for which kind of terms should be used preferably are: o For "qualifying constituent(s)-content and / or energy-content per unit": quantitative element-, substance-, or energy-content, expressed in units per unit of a relevant other flow property. Examples: "24% Fe", "9.6 MJ/kg net calorific value", "90.5% methane by volume". Note that often the units are not required explicitly; e.g. "24% Fe" refers per default to "mass/mass". If another relation is meant, this one has to be given explicitly, of course, e.g. "24% Fe molar" for chemical interim products or e.g. "13.5% ethanol by volume" for wine. Any ambiguity should be avoided, of course.
17	Naming pattern of flows and processes	<“Base name”; “Treatment, standards, routes”; “Mix type and location type”; “Quantitative flow properties”>.
NAMING OF ELEMENTARY FLOWS		
18	Naming of elementary flows	Substances and materials should be given a lower case first letter. Brand names should be given a upper case first letter (E.g. "benzene", "1,2,3-trichloro-benzene", "Alachlor"). Isotopes of elements (e.g. used for radioactive substances) are given the IUPAC name plus the isotope number added at the end with a hyphen (e.g. "radon-220"). Particles are to be inventoried via the widely used and understood abbreviation "PM", with further specification of the particle size class (e.g. "PM <2.5µm" or "PM unspecified".) Salts of O-containing acids are to be named according to the commonly used trivial names as also supported by IUPAC (e.g. “calcium carbonate” better than the name derived from applying the SETAC WG rule, which results in “carbonic acid, calcium salt”).

Rule #	Rule Category	Rule/ Required Nomenclature
		Other simple chemicals are to be named according to the commonly used trivial names, if widely used (e.g. "methane", "sulphuric acid", "acetone", etc.). Pesticides should be named by their commonly used trivial or even brand names when commonly used as trivial names across industry (e.g. "Alachlor" better than "2-chloro-n-(2,6-diethylphenyl)-n-(methoxymethyl)-acetamide"). Artificial splitting of fixed technical terms with change of order of the name fragments is to be avoided (e.g. "hard coal" better than “coal, hard”; the complete flow name should comprise quantitative flow properties information, e.g. "hard coal; 32.7 MJ/kg net calorific value", of course). The attributes of flows "to" for emissions and "in" for resources as foreseen in the SETAC WG document are redundant, as this information is already given by the class the flow belongs to (e.g. "Emissions to air"), as this is part of the elementary flow identifying information. For the sake of shortening the flow names this info is not be doubled in the flow name. The “…, ion” variants of metal emissions are to be joined with the elemental flow, with the exception of chromium (e.g. the flow “iron” to water should represent all variants, i.e. Fe III, Fe II, organically bound or ionic or complexed iron and metallic Fe to water; note that NO "ion" information is in the name.). The only exception are the commonly used flows “chromium III” and “chromium VI” ions, while a joint flow “chromium, unspecified” is required, too, that one joining also metallic chromium. (To be revised in view of further developed LCIA methods.) Substituted organics are to be named applying the former IUPAC recommendation, that was in place until the late 1990ies and is still widely preferred in industry practice (e.g. “1,2,3-trichloro-benzene“ better than the new IUPAC pattern that was recommended by the SETAC WG “benzene, 1,2,3-trichloro-“). CFCs and HCFCs are to be named using their trivial name. The full chemical name is to be given in the “Synonyms” field only (e.g. “HFC-227” as flow name with the chemical name "1,1,1,2,3,3,3-heptafluoro-propane" only in the "Synonyms"

Rule #	Rule Category	Rule/ Required Nomenclature
		field). Carbon dioxide and methane are to be separately inventoried whether from biogenic or fossil sources, both as emission and resource (the latter e.g. from uptake into biomass); the source is added at the end of the base name separated by a comma. (E.g. "carbon dioxide, fossil", "methane, biogenic"). A clearer specification is required for certain flows, e.g. “Wood” from primary forests, as it is unclear whether it refers to the wood only or the whole tree; extracted is however often the tree as a whole (e.g. better “Mahagony wood (Tectona grandis), without bark; standing; primary forest” instead of “wood, Mahagony, standing”. In case the bark would be extracted as well as often done in primary forests, an additional flow of “other wood biomass” would be inventoried). Last but not least: Naming is always to be unambiguous (e.g. better “ferrous chloride” or “iron II chloride” instead of the formerly SETAC recommended “iron chloride”, while in this case it is recommended to inventory this emission as the two elementary flows “iron” and “chloride” anyway; this will be addressed in the LCI method chapter of the LCA handbook.) Taking this baseline the above recommendation for nomenclature is applied to derive the names for the "ILCD reference elementary flows”.
NAMING OF PRODUCT FLOWS AND WASTE FLOWS		
19	Naming of product and waste flows	Product and waste flows are to be named using technical names, being as precise as possible, with the different types of information being documented into the four names fields as defined and illustrated for the ILCD reference format. See chapter 3.2. Other information such as represented country/region or year should not be part of the flow name but be documented in separate documentation fields. (Examples: Product flows "Aluminium extrusion profile; primary production; Production mix, at plant", "Stainless steel hot rolled coil; annealed and pickled, grade 304, austenitic, electric arc furnace route; production mix, at plant; 18% chromium, 10%

Rule #	Rule Category	Rule/ Required Nomenclature
		nickel", "Diesel; consumption mix, at refinery; 200 ppm sulphur", "Electricity AC; consumption mix, to consumer; 220V", "Corrugated board boxes; consumption mix; 16.6% primary fibre, 83.4% recycled fibre", "Polyethylene terephthalate (PET) granulate; bottle grade; production mix, at plant", "Lorry, 22t; interurban, one-way; load factor 80%, EURO 3", "Lorry, unspecified", "Incineration of polyethylene (PE); waste incinerator with dry flue gas cleaning technology; production mix", “Loaded cargo” and “Cargo at destination”. Waste flows "Household waste; production mix; 9.5 MJ/kg net calorific value", "Overburden; 0.20% lead, 0.13% zinc, 0.5% sulphur", "Waste tyres, unspecified"
NAMING OF PROCESSES		
20	Naming of processes	The name of process data sets with exactly one "reference flow" should be identical to the name of that reference flow. Geographical and data set age information is documented not as part of the flow or process name, but in a separate documentation field. The name of multi-functional process data sets with more than one "reference flow" should combine the name of the technology / plant represented and include information on all reference flows. The name of process data sets with quantitative references other than "reference flow" (e.g. “functional unit”, “production period”, "other flow", etc.) should be named according to their quantitative reference. If required for clarity, this name should be combined with the technology or plant name.
CLASSIFICATION, NOMENCLATURE, AND ASSIGNMENT OF FLOW PROPERTIES, UNIT GROUPS, AND UNITS		
CLASSIFICATION OF FLOW PROPERTIES AND UNIT GROUPS		
21	Classification for flow properties	“Technical flow properties" (e.g. "Net calorific value", "Mass" etc.) "Chemical composition of flows" (e.g. "Iron content", "Methane content" etc.) "Economic flow properties” (e.g. "Market value US 1997, bulk

Rule #	Rule Category	Rule/ Required Nomenclature
		prices", "Market value EU-27 2008, private consumer prices", etc.) “Other flow properties”
22	Classification of unit groups	“Technical unit groups" (e.g. "Units of energy", "Units of mass", etc.) "Economic unit groups" (e.g. "Units of currency 1997", "Units of currency 1998", etc.) “Other unit groups” Note that no "Chemical composition unit groups" class is required, as the related flow properties / LCIA factors will always use technical Unit groups and units (e.g. mass, volume, etc.). E.g. it will be "kg" Iron content (per given reference unit of an enriched ore flow, i.e. kg Fe per kg iron ore).
NAMES OF FLOW PROPERTIES, UNIT GROUPS AND UNITS; THEIR ASSIGNMENT TO FLOWS		
23	Reference flow properties and reference units for types of flows, first criterion	All flows that possess a mass, are measured in the flow property “Mass”, as long as none of the below rules would require to use a different flow property. The unit group for mass is “Units of mass” with the reference unit “kg”.
24	Reference flow properties and reference units for types of flows, second criterion	Elementary flows, for which the energy content is the most relevant unit, are measured in the flow property “Net calorific value”. The unit group for the net calorific value is “Units of energy” with the reference unit “MJ”. Product and waste flows such as fuels, in contrast, can be measured as is general usage, e.g. in mass (e.g. diesel, hard coal, etc.), normal volume (e.g. natural gas), "Net calorific value" with the unit "MJ", or other. Note that for Uranium ore, for which a net calorific value per se cannot be given, the usable fission energy content is expressed nevertheless as "Net calorific value" to ease aggregation with other fossil energy resources to primary energy consumption figures.
25	Reference flow properties and reference units for types of flows,	Product and waste flows that are typically dealt with in standard volume and for which none of the other units named in this chapter is in use in practice, are measured in the flow

Rule #	Rule Category	Rule/ Required Nomenclature
	further criteria:	property “Standard volume” (e.g. for the product flows “Compressed air; 10 bar”, "Oxygen; from refill gas cylinder of 40 l; 150 bar", etc.). Not applicable to elementary flows. The unit group is “Units of volume” with the reference unit “m3”. Elementary flows for which the substance’s radioactivity is in focus, are measured in the flow property “Radioactivity” (e.g. elementary flow "thallium-201"). The unit group is “Units of radioactivity” with the reference unit “kBq”, i.e. Kilo-Becquerel. Flows that are typically dealt with in number of items are measured in the flow property “Number” (e.g. product flows "Spare tyre passenger car; generic average", "Milk cow; Holstein, alive, start of lactation" etc.). The unit group is “Units of items” with the reference unit “Item(s)". Product and waste flows that are typically dealt with in length or distance are measured in the flow property “Length” (e.g. product flows "Welding seam; MIG/MAG, steel on steel" and "Water pipe; copper; max 5 bar, 15mm diameter", etc.). Not applicable to elementary flows. The unit group is “Units of length” with the reference unit “m”. Product and waste flows that are typically dealt with in duration are measured in the flow property “Time” (e.g. product flow / functional unit "Storage in warehouse; unheated"). Not applicable to elementary flows. The unit group is “Units of time” with the reference unit “d”, i.e. days. Product and waste flows that are typically dealt with in weight multiplied with distance are measured in the flow property “Mass*length” (e.g. product flow / functional unit "Road transport; bulk goods, generic mix; long distance"). Not applicable to elementary flows. The unit group is “Units of mass*length” with the reference unit “t*km”.

Rule #	Rule Category	Rule/ Required Nomenclature
		Product and waste flows that are typically dealt with in volume multiplied with distance are measured in the flow property “Volume*length” (e.g. product flow / functional unit "Road transport; voluminous goods, generic mix; long distance"). Not applicable to elementary flows. The unit group is “Units of volume*length” with the reference unit “m3*km”. Person transport product flows / functional units are given in the flow property “Person*distance”. Not applicable to elementary flows. The unit group is “Units of items*length” with the reference unit “Items*km”. Flows that are typically dealt with in surface area are measured in the flow property “Area” (e.g. elementary flow "Land conversion; XY specification", product flow / functional unit "Surface cleaning; heavily soiled, plastic; 1 m2"). The unit group is “Units of area” with the reference unit “m2”. Flows that are typically dealt with in surface area multiplied with time are measured in the flow property “Area*time” (e.g. elementary flow "Land occupation; XY specification", product flow / functional unit "Façade weather protection; exposed, white; 70% reflection"). The unit group is “Units of area*time” with the reference unit “m2*a”. (1 year approximated as 365 days) Product and waste flows that are typically dealt with in volume multiplied with time are measured in the flow property “Volume*time” (e.g. product flow / functional unit "Landfill occupation"). Not applicable to elementary flows. The unit group is “Units of volume*time” with the reference unit “m3*a”. (1 year approximated as 365 days) For products where the content of specific elements or of well defined chemical compounds is of interest, the respective information should be given as secondary flow property for conversion, display or modelling purposes. This is done using flow properties of the type “Substance/element X content”, e.g. “Cadmium content”, “Ammonia content”, “Water content”,

Rule #	Rule Category	Rule/ Required Nomenclature
		"Methane content" etc. (Nomenclature for the element or substance name should be identical to the one for these elements or substances as given elsewhere in this document). Depending on the specific interest, the information can be given in mass or volume units: E.g. "Iron content" in the product flow "Iron ore, enriched; floating …" as mass information or "Methane content" in the product flow "Natural gas; …" volumetric. The required "Unit group data set" is then the same as already defined "Units of mass" and "Units of volume", i.e. there is no necessity to define new Unit group data sets. For product and waste flows where the economic value should be given (typically as secondary flow property for allocation purposes or cost calculation in Life Cycle Costing) this is done using the flow property "Market value", which is further specified as required, typically referring to the country or region, time period, and wholesale/retail etc. situation, by adding the respective information: E.g. "Market value US 1997, bulk prices", "Market value EU 2000, private consumer prices". (Can be used for e.g. product / waste / elementary flows "Gold", "Waste tyres", "Carbon dioxide", etc.). The unit group name is formed by the combination of the string "Units of currency" and an addition that characterises the time period to which it refers, e.g. "1997", "1990-1999", "May 1995" etc., e.g. "Units of currency 1997" with the reference unit "EUR", i.e. Euro. (Note: The reference to a time period is required to allow giving correct average conversion numbers for other currencies for that time period).
NOMENCLATURE FOR NEW FLOW PROPERTIES, UNIT GROUPS, AND UNITS		
26	Creation and naming of flow properties, unit groups and units	The creation/use of new flow properties, unit groups and units should be avoided, if possible, and any of the existing ones as provided in the upcoming more complete list of the ILCD system should be used. If the creation of new flow properties and unit groups is unavoidable (as to be expected e.g. for economic flow properties), they should be named following the same pattern as the ones above, i.e. flow properties carry the name of the physical or other property, units carry the unit short as name (with the option to provide a long name and further info in the

Rule #	Rule Category	Rule/ Required Nomenclature
		comment field foreseen in the data format). Unit groups are named by a combination of the string “Units of” and the name of the flow property they refer to. Please note, that in some cases it is useful to have common unit groups for more than one flow property were all are measured in the same units. In such cases the naming can be referred to a more general flow property (e.g. “Energy” □ “Units of energy”) and not only to one specific one (e.g. NOT “Units of net calorific value” or “Units of exergy” etc.).
CLASSIFICATION OF CONTACTS		
27	Classification of contact data sets	"Group of organisations, project" "Organisations" "Private companies" "Governmental organisations" "Non-governmental organisations" "Other organisations" "Working groups within organisations" "Persons" "Other"
CLASSIFICATION OF SOURCES		
28	Classification of source data sets	"Images" "Data set formats" "Databases" "Compliance systems" "Statistical classifications" "Publications and communications" "Other source types"

Example of Identifying Appropriate Nomenclature and Properties for Specific Flows

Raw material, Input: Crude oil (Rules 2,4,5)

(1)Specify "elementary flow category" by receiving / providing environmental compartment:

Example: Resources - Resources from ground

(2) Further differentiation of providing/receiving environmental compartments

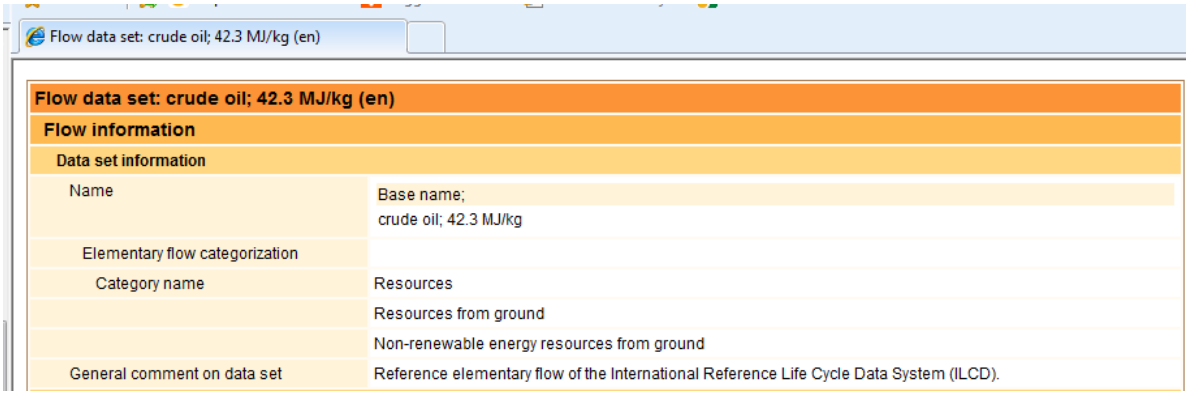
Example: Non-renewable energy resources from ground

(3)additional, non-identifying classification for "Resources from ground" elementary flows

Example:

Example: Non-renewable energy resources from ground ” (e.g. "Crude oil; 42.3 MJ/kg net calorific value")

Flow data set: Crude oil: 42.3 MJ/kg net calorific value



Ref: http://lct.jrc.ec.europa.eu/

Emission, output: Example: Carbon Dioxide (Rules 2,4,9)

:(1) Specify "elementary flow categories" by receiving / providing environmental compartment:

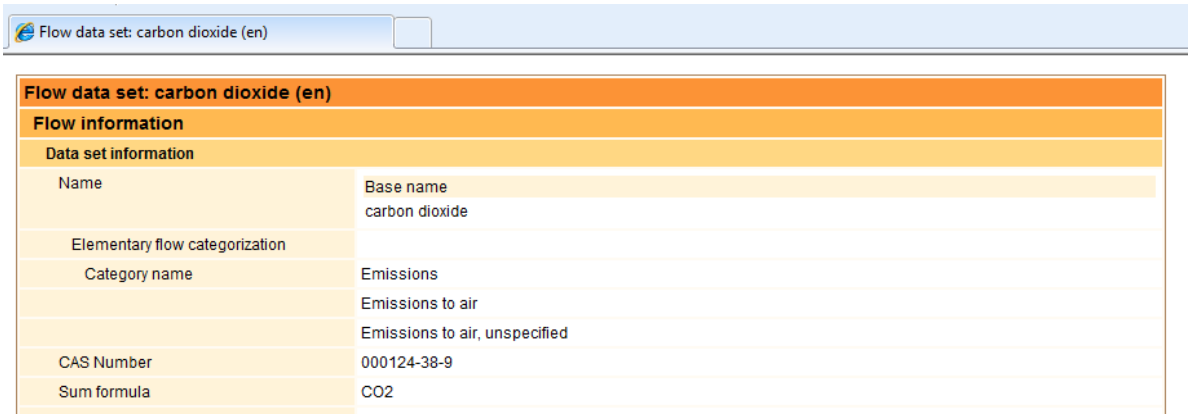
Example: Emissions – Emissions to air - Emissions to air, unspecified

(2) Further differentiation of providing/receiving environmental compartments

Example: “Emission to air, DE”

(3) additional, non-identifying classification for emissions

Example: Inorganic covalent compounds” (e.g. "Carbon dioxide, fossil", "Carbon monoxide", "Sulphur dioxide", "Ammonia", etc.)


Flow data set: carbon dioxide (en)

Flow data set: carbon dioxide (en)	
Flow information	
Data set information	
Name	Base name carbon dioxide
Elementary flow categorization	
Category name	Emissions
	Emissions to air
	Emissions to air, unspecified
CAS Number	000124-38-9
Sum formula	CO2

Ref: http://lct.jrc.ec.europa.eu/

Product flow: Example: T-shirt (Rules 10-17)

(1) top-level classification for Product flows, Waste flows, and Processes:

Example: “System”

(2) second level classifications for Product flows, Waste flows, and Processes (for preceding top-level classification):

Example: “Textiles, furniture and other interiors”

(3) “Base name” field:

Example: “Base Name: White polyester T-shirt”

(4) “Treatment, standards, routes” name field:

Example: “ ”

(5) “Mix type and location type” name field:

“Production mix, at point of sale”

(6) “Quantitative flow properties” name field:

Example: “160 grams polyester”

(7) naming pattern of flows and processes.

<“Base name”; “Treatment, standards, routes”; “Mix type and location type”; “Quantitative flow properties”>.

Example: “White polyester T-shirt; product mix at point of sale; 160 grams polyester”

Annex V. Example Organisation Environmental Footprint Report Template

Goals of the Organisation Environmental Footprint Study	
Items	Description
Company name **Filled in by** **Name** **Position** **Email** **Phone number**	
Intended application(s)	
Reasons for carrying out the study	
Limitations/Assumptions	
Target audience(s)	
Commissioner of the Study	
Review Procedure	

Scope of Organisation Environmental Footprint Study	
Items	Description
Definition of the Organisation (unit of analysis)	• The name of the organisation

	• The kinds of products/services the organisation produces • Locations of facilities			
Definition of the Product/Service Portfolio	Goods and services marketed by the organisation over the reporting interval (one year) in terms of "what" and "how much". If required for the intended application (for example, modeling product/service use and end-of-life scenarios), also include information on "how well", and "for how long" with respect to product/service performance			
Reference time of the study (reporting year)				
Organisational Boundaries (specify included facilities and processes)				
Analytical Boundaries	Cradle to cradle	Cradle to grave	Cradle to gate	Gate to gate
Description of Organisation Environmental Footprint boundaries (specify included supply chain stages and processes)	For evaluation of direct impacts (i.e. within the defined organisational boundary): i) Site-level activities (direct use of materials/energy inputs and associated waste streams and emissions) ii) Capital equipment iii) Business travel iv) Client and visitor transportation v) Employee commuting vi) Transportation from supplier (when transport means are owned/operated by the organisation) vii) Other site-specific activities In addition, for evaluation of indirect, upstream impacts (if included in the analysis):			

	viii) Purchased products/services ix) Any other relevant upstream processes In addition, for evaluation of indirect, downstream impacts (if included in the analysis): xi) Transportation & distribution of sold products/services to the client (including storage and retail) xii) Use stage of the products/services xiii) End of life of the products/services xiv) Any other relevant downstream processes
System boundary diagram	
Cut-off criteria	
Environmental Footprint Impact Categories	

Resource Use and Emissions Profile **(complete one form for each environmentally significant process)**	
Item	Description
Datum collection procedure	
Datum source	
Datum description	
Datum manipulation/calculation	

Multi-functionality solution (if any) and justification	
Resource Used or Emission (include units)	

Environmental Footprint Impact Assessment		
Impact category/method	Result	Unit
Climate Change		
Toxicity		
…		

Interpretation	
Identification of significant issues	
Identification of uncertainties	
Conclusions and recommendations	
Limitations	