Organisation Environmental Footprint Sector Rules Guidance

Version 6.3 – May 2018

Preface

This document (henceforward, the OEFSR Guidance) provides instructions on how to develop Organisation Environmental Footprint Sector Rules (OEFSRs). The content of this OEFSR Guidance will be periodically revised by European Commission services. The OEFSRs developed during the Environmental Footprint phase shall be fully in line with this version of the guidance. Any derogation from this general rule is only possible with the agreement of the Commission.

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For any technical question related to the content of this guidance, please refer to the functional mailbox env-environmental-footprint@ec.europa.eu

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AF	Allocation Factor
AR	Allocation Ratio
B2B	Business to Business
B2C	Business to Consumer
BoC	Bill of Components
BoM	Bill of Materials
CF	Characterization Factor
CFF	Circular Footprint Formula
CFF-M	Circular Footprint Formula – Modular form
CMWG	Cattle Model Working Group
CPA	Classification of Products by Activity
DC	Distribution Centre
DMI	Dry Matter Intake
DNM	Data Needs Matrix
DQR	Data Quality Rating
EA	Economic Allocation
EC	European Commission
EF	Environmental Footprint
EI	Environmental Impact
EoL	End-of-Life
FU	Functional Unit
GE	Gross Energy intake
GR	Geographical Representativeness
GHG	Greenhouse Gas
GWP	Global Warming Potential
HD	Helpdesk
ILCD	International Reference Life Cycle Data System
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organisation for Standardisation
JRC	Joint Research Centre
LCA	Life Cycle Assessment
LCDN	Life Cycle Data Network
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
LT	Lifetime
NACE	Nomenclature Générale des Activités Economiques dans les Communautés Européennes
NDA	Non Disclosure Agreement
NGO	Non-Governmental Organisation
NMVOC	Non-methane volatile compounds
OEF	Organisation Environmental Footprint
OEFSR	Organisation Environmental Footprint Sector Rule
P	Precision
PCR	Product Category Rules
PEF	Product Environmental Footprint
PEFCR	Product Environmental Footprint Category Rules
RF	Reference Flow
RO	Representative Organisation
SB	System Boundary
SC	Steering Committee

399	**SMRS**	Sustainability Measurement & Reporting System
400	**SS**	Supporting study
401	**TAB**	Technical Advisory Board
402	**TeR**	Technological Representativeness
403	**TiR**	Time Representativeness
404	**TS**	Technical Secretariat
405	**UNEP**	United Nations Environment Programme
406	**UUID**	Universally Unique Identifier

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4 List of terms and definitions

For all terms used in this Guidance and not defined below, please refer to the most updated version of the Organisation Environmental Footprint (OEF) Guide, ISO 14025:2006, ISO 14040-44:2006, and the ENVIFOOD Protocol.

Activity data - This term refers to information which is associated with processes while modelling Life Cycle Inventories (LCI). In the OEF Guide it is also called “non-elementary flows”. The aggregated LCI results of the process chains that represent the activities of a process, are each multiplied by the corresponding activity data[1] and then combined to derive the environmental footprint associated with that process (See Figure 1). Examples of activity data include quantity of kilowatt-hours of electricity used, quantity of fuel used, output of a process (e.g. waste), number of hours equipment is operated, distance travelled, floor area of a building, etc. In the context of OEF the amounts of ingredients from the bill of material (BOM) shall always be considered as activity data.

Aggregated dataset - This term is defined as a life cycle inventory of multiple unit processes (e.g. material or energy production) or life cycle stages (cradle-to-gate), but for which the inputs and outputs are provided only at the aggregated level. Aggregated datasets are also called "LCI results", “cumulative inventory” or “System processes” datasets. The aggregated dataset can have been aggregated horizontally and/or vertically. Depending on the specific situation and modelling choices a "unit process" dataset can also be aggregated. See Figure 1[2].

Application specific - It refers to the generic aspect of the specific application in which a material is used. For example, the average recycling rate of PET in bottles.

Bill of materials – A bill of materials or product structure (sometimes bill of material, BOM or associated list) is a list of the raw materials, sub-assemblies, intermediate assemblies, sub-components, parts and the quantities of each needed to manufacture an end product.

[1] Based on GHG protocol scope 3 definition from the Corporate Accounting and Reporting Standard (World resources institute, 2011).

[2] Source: UNEP/SETAC “Global Guidance Principles for LCA Databases"

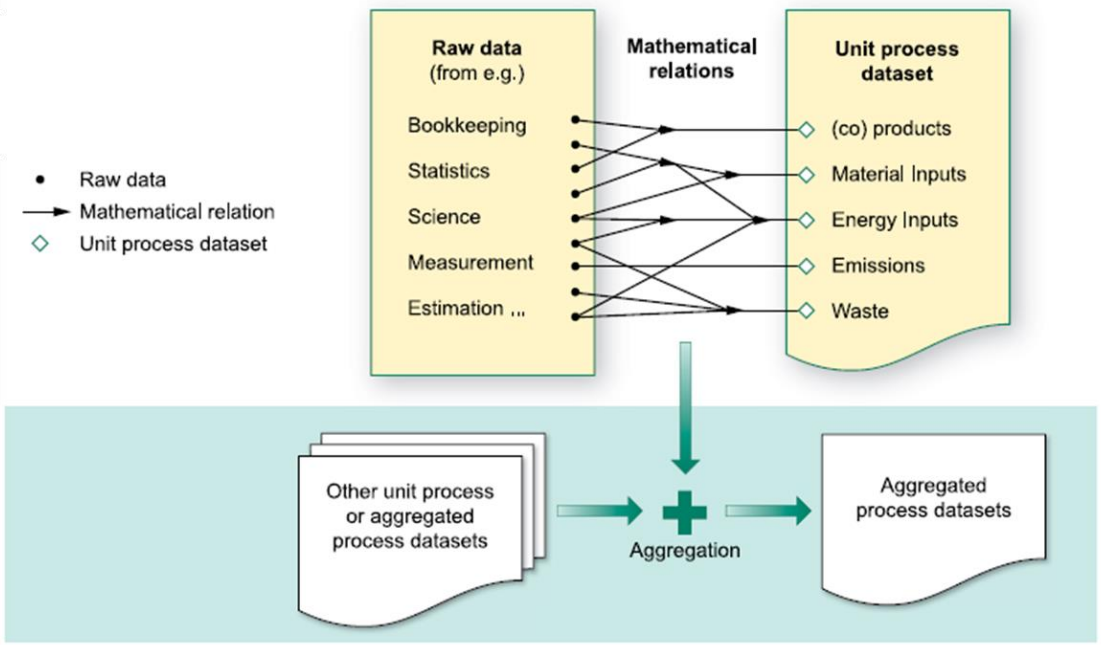

Figure 1. Definition of a unit process dataset and an aggregated process dataset

Business to Business (B2B) – Describes transactions between businesses, such as between a manufacturer and a wholesaler, or between a wholesaler and a retailer.

Business to Consumers (B2C) – Describes transactions between business and consumers, such as between retailers and consumers. According to ISO 14025:2006, a consumer is defined as "an individual member of the general public purchasing or using goods, property or services for private purposes".

Commissioner of the EF study - Organisation (or group of organisations) that finances the EF study in accordance with the EF Guide, EF Guidance and the relevant OEFSR, if available (definition adapted from ISO 14071/2014, point 3.4).

Company-specific data – It refers to directly measured or collected data from one or multiple facilities (site-specific data) that are representative for the activities of the company. It is synonymous to "primary data". To determine the level of representativeness a sampling procedure can be applied.

Comparative assertion – An environmental claim regarding the superiority or equivalence of one organisation versus a competing organisation that operates in the same sector, based on the results of an OEF study and supporting OEFSRs.

Comparison – A comparison, not including a comparative assertion, (graphic or otherwise) of two or more organisations/production sites/time frames based on the results of an OEF study, and supporting OEFSRs. Comparing production sites or time frames within the same company falls under this definition and is not a comparative assertion.

Data Quality Rating (DQR) - Semi-quantitative assessment of the quality criteria of a dataset based on Technological representativeness, Geographical representativeness, Time-related

representativeness, and Precision. The data quality shall be considered as the quality of the dataset as documented.

Direct elementary flows (also named elementary flows) - All output emissions and input resource use that arise directly in the context of a process. Examples are emissions from a chemical process, or fugitive emissions from a boiler directly onsite. See Figure 2.

Disaggregation - The process that breaks down an aggregated dataset into smaller unit process datasets (horizontal or vertical). The disaggregation can help making data more specific. The process of disaggregation should never compromise or threat to compromise the quality and consistency of the original aggregated dataset

EF communication vehicles - It includes all the possible ways that can be used to communicate the results of the EF study to the stakeholders. The list of EF communication vehicles includes, but it is not limited to, labels, environmental product declarations, green claims, websites, infographics, etc.

EF report - Document that summarises the results of the EF study. For the EF report the template provided as annex to the PECFR Guidance and OEFSR Guidance shall be used. In case the commissioner of the EF study decides to communicate the results of the EF study (independently from the communication vehicle used), the EF report shall be made available for free through the commissioner's website. The EF report shall not contain any information that is considered as confidential by the commissioner, however the confidential information shall be provided to the verifier(s).

EF study - Term used to identify the totality of actions needed to calculate the EF results. It includes the modelisation, the data collection, and the analysis of the results.

Electricity tracking[3] - Electricity tracking is the process of assigning electricity generation attributes to electricity consumption.

Elementary flow - Material or energy entering the system being studied that has been drawn from the environment without previous human transformation, or material or energy leaving the system being studied that is released into the environment without subsequent human transformation.

EMAS - Eco-Management and Audit Scheme (REGULATION (EC) No 1221/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS). EMAS is a premium management instrument developed by the European Commission for companies and other organisations to evaluate, report, and improve their environmental performance. EMAS is open to every type of organisation and spans all economic and service sectors and is applicable worldwide.

EMAS Sectoral Reference Documents (EMAS SRDs) – Documents developed according to Art. 46 of the EMAS Regulation4, which contain best environmental management practice, environmental

[3] https://ec.europa.eu/energy/intelligent/projects/en/projects/e-track-ii
[4] Regulation (EC) No 1221/2009

performance indicators for specific sectors and, where appropriate, benchmarks of excellence and rating systems identifying environmental performance levels.

Environmental aspect – Element of an organization's activities or products or services that interacts or can interact with the environment (ISO 14001:2015)

External Communication - Communication to any interested party other than the commissioner or the practitioner of the study.

Foreground elementary flows - Direct elementary flows (emissions and resources) for which access to primary data (or company-specific information) is available.

Independent external expert - Competent person, not employed in a full-time or part-time role by the commissioner of the EF study or the practitioner of the EF study, and not involved in defining the scope or conducting the EF study (adapted from ISO 14071/2014, point 3.2).

Input flows – Product, material or energy flow that enters a unit process. Products and materials include raw materials, intermediate products and co-products (ISO 14040:2006).

Intermediate product - An intermediate product is a product that requires further processing before it is saleable to the final consumer.

Lead verifier - Verifier taking part in a verification team with additional responsibilities compared to the other verifiers in the team.

Life Cycle Inventory (LCI) - The combined set of exchanges of elementary, waste and product flows in a LCI dataset.

Life Cycle Inventory (LCI) dataset - A document or file with life cycle information of a specified product or other reference (e.g., site, process), covering descriptive metadata and quantitative life cycle inventory. A LCI dataset could be a unit process dataset, partially aggregated or an aggregated dataset.

Material-specific - It refers to a generic aspect of a material. For example, the recycling rate of PET.

OEF Profile – The quantified results of an OEF study. It includes the quantification of the impacts for the various impact categories and the additional environmental information considered necessary to be reported.

OEF screening – A preliminary study carried out on the representative organisation, and intended to identify the most relevant life cycle stages, processes, elementary flows, impact categories, data quality needs, and any other major requirement to be part of the final OEFSR.

OEFSR Supporting study – An OEF study done on the basis of a draft OEFSR. It is used to confirm the decisions taken in the draft OEFSR before the final OEFSR is released.

Organisation - A company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private. For the purpose of calculating

the OEF, the function of the organisation is defined as the provision of products (i.e. goods and services) over a specified reporting interval, thus it is defined with reference to its Product Portfolio.

Organisational claims – Any form of communication regarding an organisation's environmental performance, such as reports, responses to questionnaires, declarations and press releases. Herein claims refer exclusively to those based on a life cycle assessment (LCA-based claims).

Organisation Environmental Footprint Sector Rules (OEFSRs) – Sector-specific, life-cycle-based rules that complement general methodological guidance for OEF studies by providing further specification at the level of a specific sector. OEFSRs help to shift the focus of the OEF study towards those aspects and parameters that matter the most, and hence contribute to increased relevance, reproducibility and consistency of the results whilst reducing costs in comparison to a study based on the comprehensive requirements of the OEF Guide. OEFSRs are defined primarily with reference to the activities characteristic of the sector, as represented in a typical Product Portfolio.

Output flows – Product, material or energy flow that leaves a unit process. Products and materials include raw materials, intermediate products, co-products and releases (ISO 14040:2006).

Partially disaggregated dataset - A dataset with a LCI that contains elementary flows and activity data, and that only in combination with its complementing underlying datasets yield a complete aggregated LCI data set. We refer to a partially disaggregated dataset at level 1 in case the LCI contains elementary flows and activity data, while all complementing underlying datasets are in their aggregated form (see an example in Figure 2).

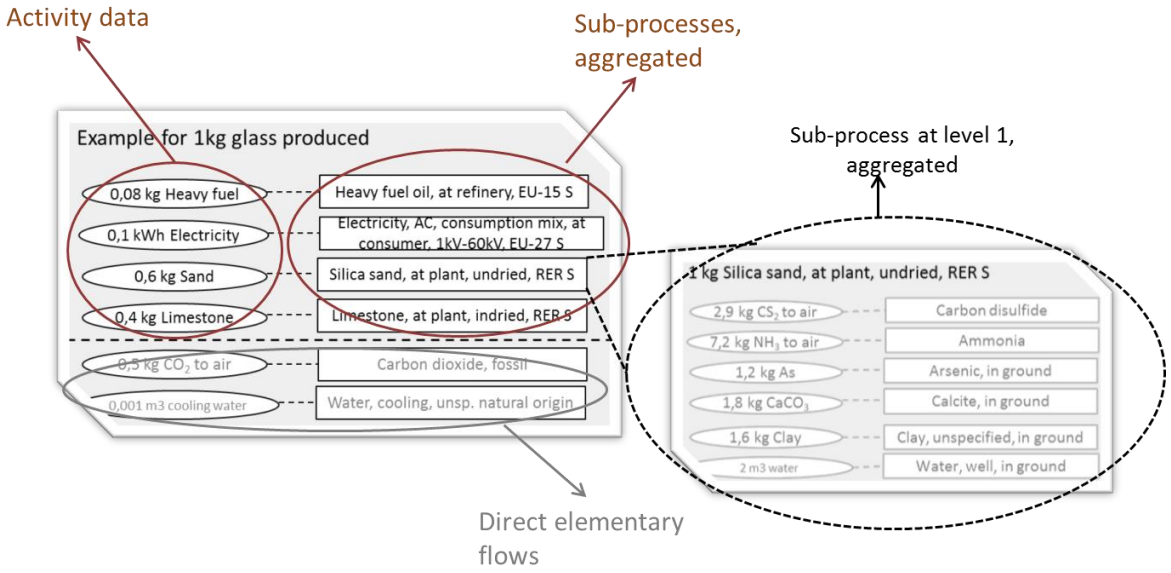

Figure 2. An example of a partially disaggregated dataset, at level 1. The activity data and direct elementary flows are to the left, and the complementing sub-processes in their aggregated form are to the right. The grey text indicates elementary flows

Population - Any finite or infinite aggregation of individuals, not necessarily animate, subject to a statistical study.

Practitioner of the EF study - Individual, organisation or group of organisations that performs the EF study in accordance with the EF Guide, EF Guidance and the relevant OEFSR, if available. The

practitioner of the EF study can belong to the same organisation as the commissioner of the EF study (adapted from ISO 14071/2014, point 3.6).

Primary data[5] **-** This term refers to data from specific processes within the supply-chain of the company applying the OEFSR. Such data may take the form of activity data, or foreground elementary flows (life cycle inventory). Primary data are site-specific, company- specific (if multiple sites for the same product) or supply-chain-specific. Primary data may be obtained through meter readings, purchase records, utility bills, engineering models, direct monitoring, material/product balances, stoichiometry, or other methods for obtaining data from specific processes in the value chain of the company applying the OEFSR. In this Guidance, primary data is synonym of "company-specific data" or supply-chain-specific data".

Product Portfolio - The Product Portfolio refers to the amount and nature of goods and services provided by the Organisation over the reporting interval, which should be one year.

Refurbishment - The process of restoring components to a functional and/or satisfactory state to the original specification (providing the same function), using methods such as resurfacing, repainting, etc. Refurbished products may have been tested and verified to function properly.

Representative organisation (model) - The “representative organisation” is a real or fictive organisation that is typical for the given sector and Product Portfolio. Especially when technologies and the composition of Production Portfolios within a sector are varied, the “representative organisation” can be a virtual (non-existing) organisation, built, for example, with the average EU sales-weighted characteristics of all technologies used, using the Product Portfolio as a reference. If appropriate, an OEFSR might include more than one representative organisation (business unit).

Representative sample - A representative sample with respect to one or more variables is a sample in which the distribution of these variables is exactly the same (or similar) as in the population from which the sample is a subset

Sample - A sample is a subset containing the characteristics of a larger population. Samples are used in statistical testing when population sizes are too large for the test to include all possible members or observations. A sample should represent the whole population and not reflect bias toward a specific attribute.

Secondary data[6] **-**It refers to data not from specific process within the supply-chain of the company applying the OEFSR. This refers to data that is not directly collected, measured, or estimated by the company, but sourced from a third-party life-cycle-inventory database or other sources. Secondary data includes industry-average data (e.g., from published production data, government statistics,

[5] Based on GHG protocol scope 3 definition from the Corporate Accounting and Reporting Standard (World resources institute, 2011).

[6] Based on GHG protocol scope 3 definition from the Corporate Accounting and Reporting Standard (World resources institute, 2011)

and industry associations), literature studies, engineering studies and patents, and can also be based on financial data, and contain proxy data, and other generic data. Primary data that go through a horizontal aggregation step are considered as secondary data.

Sector – A sector is defined with reference to the characteristic sectorial Product Portfolio, defined using NACE codes (i.e. in line with the Nomenclature générale des Activités Economiques dans les Communautés Européennes NACE Rev. 2).

Site-specific data – It refers to directly measured or collected data from one facility (production site). It is synonymous to “primary data”.

Sub-population - In this document this term indicates any finite or infinite aggregation of individuals, not necessarily animate, subject to a statistical study that constitutes a homogenous sub-set of the whole population. Sometimes the word "stratum" can be used as well.

Sub-processes - Those processes used to represent the activities of the level 1 processes (=building blocks). Sub-processes can be presented in their (partially) aggregated form (see Figure 2).

Sub-sample - In this document this term indicates a sample of a sub-population.

Supply-chain – It refers to all of the upstream and downstream activities associated with the operations of the company applying the OEFSR, including the use of sold products by consumers and the end-of-life treatment of sold products after consumer use.

Supply-chain specific – It refers to a specific aspect of the specific supply-chain of a company. For example the recycled content value of an aluminium can produced by a specific company.

Type III environmental declaration – An environmental declaration providing quantified environmental data using predetermined parameters and, where relevant, additional environmental information (ISO 14025:2006). The predetermined parameters are based on the ISO 14040 series of standards, which is made up of ISO 14040 and ISO 14044.

Unit process dataset - Smallest element considered in the life cycle inventory analysis for which input and output data are quantified (ISO 14040:2006). In LCA practice, both physically not further separable processes (such as unit operations in production plants, then called “unit process single operation”) and also whole production sites are covered under "unit process", then called “unit process, black box” (ILCD Handbook).

Validation statement - Conclusive document aggregating the conclusions from the *verifiers* or the verification team regarding the EF study. This document is mandatory and shall be electronically or physically signed by the *verifier or in case of a* verification panel, by the lead verifier. The minimum content of the verification statement is provided in this document.

Verification report - Documentation of the verification process and findings, including detailed comments from the *Verifier(s)*, as well as the corresponding responses.. This document is mandatory, but it can be confidential. However, it shall be signed, electronically or physically, by the *verifier or in case of a* verification panel, by the lead verifier.

Verification team - Team of verifiers that will perform the verification of the EF study, of the EF report and the EF communication vehicles.

Verifier - Independent external expert performing a verification of the EF study and eventually taking part in a verification team.

5 Rationale

The Organisation Environmental Footprint (OEF) is a Life Cycle Assessment (LCA) based method to quantify the relevant environmental impacts of an organisation. It builds on existing approaches and international standards[7], even if using LCA for organisation-level assessment represents a relatively novel approach.

At organisational level, the importance of the environmental impacts occurring in the supply chain is increasingly recognised. Standards and methods were created, such as the GHG Protocol Corporate Standard and its sectoral guidance or Global Reporting Initiative indicators. At EU level, the EMAS Sectoral Reference Documents include guidance regarding indirect impacts highlighting also the use of LCA-methods for evaluation of the respective product portfolio (PP).

These initiatives indicate the growing demand for such information from both public and private actors. They also represent a problem as too often methods and specific guidance are "similar but still different", what limits their applicability to make informed and meaningful comparisons (i) between organisations or production sites within a same sector having similar product portfolios, or (ii) of the performance of a single organisation or production site throughout time. Consistent and comparable information is important for any application that requires establishing the performance of an organisation respectively to peers in a sector (e.g. sustainability indices, potential use in green public procurement, performance league tables) or where decisions are made based on performance improvement (e.g. incentives tied to environmental performance improvement, conditionality for grants, investor analysis regarding the management of non-financial risk). One important feature of OEF is that it sets the basis for a harmonised approach across organisations that go beyond carbon footprinting.

This Guidance represents a contribution to meeting these challenges. It has been written trying to be as much as possible in line with similar major standards and initiatives. Consistency with the Organisation Environmental Footprint (OEF) and, where appropriate, Organisation Environmental Footprint Sector Rules (OEFSRs) ensure complementarity between the tools and streamlines processes for organisations wishing to apply OEF.

5.1 Terminology: shall, should and may

This Guidance uses precise terminology to indicate the requirements, the recommendations and options that could be chosen when developing an OEFSR.

The term “shall” is used to indicate what is required in order for an OEFSR to be in conformance with this OEFCR Guidance.

[7] Analysis of Existing Environmental Footprint Methodologies for Products and Organizations: Recommendations, Rationale, and Alignment, JRC, 2011, http://ec.europa.eu/environment/eussd/pdf/Deliverable.pdf

The term "should" is used to indicate a recommendation rather than a requirement. Any deviation from a "should" requirement has to be justified when developing the OEFSR and made transparent.

The term "may" is used to indicate an option that is permissible. Whenever options are available, the OEFSR shall include adequate argumentation to justify the chosen option.

5.2 Definition and purpose of an OEFSR

An OEFSR is a sector-specific guidance document with the primary objective to fix a consistent set of rules to calculate the potential environmental impacts of an organisation in a given sector. Sector-specific rules analogous to OEFSRs exist in standards for calculating GHG emissions, such as the GHG Protocol. OEFSRs were named differently in order to prevent confusion with other analogous rules and uniquely identify rules under the OEF Guide.

Based on an analysis carried out by JRC in 2010[8], the Commission came to the conclusion that existing life cycle-based standards do not provide sufficient specificity to ensure that the same assumptions, measurements and calculations are made to comply with a harmonised approach across organisations within a same sector. In order to address this limitation, the use of OEFSRs will play an important role in increasing the reproducibility, relevance, and consistency of OEF studies (and therefore comparability between OEF calculations over time and, if possibly, within the sector).

OEFSRs should be developed and written in a format that persons with technical knowledge (in LCA as well as with regard to the considered product category) can understand it and use it to conduct an OEF study. The OEFSRs shall implement the materiality principle, meaning that an OEF study shall focus on those aspects and parameters that are the most relevant in determining the environmental performance of a given organization. By doing this the time, efforts and costs necessary to carry out the analysis are reduced

Each OEFSR shall specify the minimum list of processes (called mandatory processes) that shall always be covered by company-specific data. The purpose is to avoid that an applicant without access to the relevant organisation-specific primary data is allowed to perform an OEF study and communicate its results by only applying default data. The OEFSR shall define this mandatory list of processes based on the relevance and the possibility to have access to company-specific data. An OEFSR shall further specify requirements made in the general OEF Guide and shall add new requirements where the OEF Guide provides several choices or where the OEF Guide does not cover sufficiently the particularity of life cycle of a specific sector.

OEFSRs shall be developed according to the latest version available of this Guidance. Whenever there are conflicting requirements between this Guidance and the most recent version of the OEF Guide adopted by the Commission, the former prevails over the latter. In the absence of an

[8] Analysis of Existing Environmental Footprint Methodologies for Products and Organizations: Recommendations, Rationale, and Alignment (2010), available at: http://ec.europa.eu/environment/eussd/smgp/dev_methods.htm

approved OEFSR an OEF study shall be carried out in compliance with the most recent version of the OEF Guide adopted by the Commission and this OEFSR Guidance.

For OEFSRs dealing with food, feed, and drinks, the most recent version of the ENVIFOOD Protocol shall be used as complementary guidance to the requirements in the OEF Guide and this OEFSR guidance. In case of conflicting requirements between the OEF Guide (or this OEFSR Guidance) and the ENVIFOOD Protocol, the first prevail over the second.

5.3 Relationship to other methods and standards

This Guidance includes several elements taken from other relevant documents such as:

- Organisation Environmental Footprint (OEF) Guide, Annex to Commission Recommendation 2013/179/EU on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations (April 2013)[9]
- Guidance for Product Category Rule Development[10]
- ISO 14025:2006 - Environmental labels and declarations – Type III environmental declarations – Principles and procedures (ISO)
- BP X30-323-0:2011 - Principes généraux pour l'affichage environnemental des produits de grande consommation (AFNOR, France)
- Greenhouse Gas Product Accounting and Reporting Standard (GHG Protocol, 2011)
- PAS 2050 - Specification for the assessment of the life cycle greenhouse gas emissions of goods and services (BSI, 2011)
- ISO 14064-1:2006 – Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals
- Technical Specification ISO/TS 14067:2013 – Carbon footprint of products – Requirements and guidelines for quantification and communication
- ISO 14020:2000 Environmental labels and declarations – General principles
- ISO 14021:1999 Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling)
- ISO 14040:2006 Environmental management — Life cycle assessment —Principles and framework
- ISO 14044:2006 Environmental management — Life cycle assessment —Requirements and guidelines
- ISO 14050:2006 Environmental management — vocabulary
- ISO/TS 14067:2013 Greenhouse gases -- Carbon footprint of products -- Requirements and guidelines for quantification and communication

[9] http://ec.europa.eu/environment/eussd/smgp/index.htm

[10] Ingwersen, W., Subramanian, V., editors. Product of the Product Category Rule Guidance Development Initiative. http://www.pcrguidance.org.

- ISO 17024:2003 Conformity assessment – General requirements for bodies operating certification of persons
- Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC.

- ISO/TS 14071:2014 Environmental management — Life cycle assessment — Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006
- ISO 14046:2014 Environmental management -- Water footprint -- Principles, requirements and guidelines
- ENVIFOOD PROTOCOL - Food SCP RT (2013), ENVIFOOD Protocol, Environmental Assessment of Food and Drink Protocol, European Food Sustainable Consumption and Production Round Table (SCP RT), Working Group 1, Brussels, Belgium.

5.4 Intended audience

The intended audience of this Guidance document includes:

- stakeholders participating in the development of OEFSRs;
- stakeholders implementing an approved OEFSR;
- stakeholders carrying out an OEF study for an organization in a sector not covered by an approved OEFSR.

6 Governance and procedures

6.1 Organisational structure of the EF pilot phase

The participation to the EF pilot phase is a pro bono activity carried out by all stakeholders interested in a specific sector. In order to organise and coordinate the work in the best way possible the following structure is considered necessary:

- A Steering Committee (SC)
- A Technical Advisory Board (TAB)
- A Technical Secretariat (TS)
- An EF technical helpdesk
- An EF virtual consultation Forum (EF Wiki) (https://webgate.ec.europa.eu/fpfis/wikis/display/EUENVFP/)

6.1.1 EF Pilot Steering Committee (SC)

For the whole duration of the EF pilot phase a Steering Committee is set up.

The composition of the Steering Committee and its rules for procedure are available at: https://webgate.ec.europa.eu/fpfis/wikis/display/EUENVFP/Steering+Committee+workspace

The Commission chairs the meetings and is responsible for all activities related to its organisation and management.

The role of the Steering Committee is to:

a) Approve the scope and the definition of the organisation for each OEFSR developed within the EF pilot phase. When relevant, the opinion expressed by the Technical Advisory Board on these documents will be taken in consideration by the Steering Committee;
b) Monitor the progress in each OEFSR pilot;
c) Exchange information about challenges and lessons learnt in each pilot;
d) Decide on review requirements for the EF pilot phase;
e) Express an opinion on the second draft of an OEFSR before starting the supporting studies and the communication phase;
f) Approve the final OEFSR;
g) Contribute, review, comment on the development of the "footprint weighting method" as developed by JRC-IES;
h) Solve any conflicts that might arise during the implementation of the environmental footprint pilot exercise

When the decision of the Steering Committee might have an impact on the general requirements included in the OEF Guide, these changes shall be preventively agreed with the Commission.

6.1.2 The EF Technical Advisory Board (TAB)

Each member of the EF Pilot Steering Committee may appoint up to 1 expert to be member of the Technical Advisory Board. The Commission chairs the meetings and is responsible for all activities related to its organisation and management.

The role of the Technical Advisory Board member is (non-exhaustive list) to:

a) Provide support to the Steering Committee members that have appointed them on the scope of the product category or sector for each OEFSR developed within the EF pilot phase;
b) Check and advise the Steering Committee members on consistency of approaches among different EF pilot category/sector rules, including but not limited to how to identify the representative product/organisation and how to develop benchmarks;
c) Provide technical advice to the Steering Committee members about draft OEFSRs (based on the results of the screening);
d) Provide technical advice to the Steering Committee members in case of issues related to the implementation of OEF requirements;
e) Provide support to the Steering Committee members on decision related to review and verification;
f) Express an opinion to the Steering Committee members on the final OEFSR before approval.

Furthermore, the TAB expresses its opinion and input to the Commission on technical issues that are of cross-cutting relevance to several EF pilots.

6.1.3 The Technical Secretariat (TS)

For each pilot there shall be a Technical Secretariat. The Technical Secretariat is responsible for the following activities:

a) Overall drafting of the OEFSR proposal;
b) Preparing, maintaining and communicating all instructions related to the OEFSR development process;
c) Facilitating harmonisation with existing Sectoral rules;
d) Organising the physical consultation meetings, including preparation of the agenda, sending the invitation, drafting supporting documents, taking minutes during the meetings;
e) Organising the consultation periods according to the rules and timing specified in 6.5.2. This task includes the drafting of the OEFSR chapters, collection and analysis of the comments received, and the drafting of the document analysis how the comments have been addressed;
f) Supporting the management of the EF consultation Forum. This activity includes tasks such as the drafting of publicly available explanatory materials related to their EF pilot category rules activities and the publication of the names of the organizations (not individual names) involved as stakeholders in the OEFSR development process;
g) Ensuring that the OEF screening is performed, the representative model developed and all the OEF calculations necessary run as requested in this Guidance;

h) Periodically updating in the EF virtual consultation Forum a list of all the documents consulted during the OEFSR development process;
i) Ensuring the selection of and appointment of competent independent OEFSR review panel members.

During the EF Pilot phase the role of the Technical Secretariat may be played by a single company, an industrial association, an NGO, a Member State, or a national or an international Institution (e.g. the Commission), a university or research institute. The preferable option would be that the Technical Secretariat is constituted by a mix of the previously mentioned organisations.

The Technical Secretariat shall appoint a chair and will identify an Organisation Sector Coordinator. The chair shall coordinate the different tasks of the Technical Secretariat and chair the physical consultation meetings, whilst the Organisation Sector Coordinator represents the Technical Secretariat in the Steering Committee.

6.1.4 The EF Technical Helpdesk

For the whole duration of the EF pilot phase the Commission has made an external technical helpdesk available. The role of this helpdesk is to:

- Support the Commission in the revision of any document released by the Technical Secretariats (e.g. the representative sector model, draft OEFSR, etc.),
- support the activities of each category rule/sectoral rule pilot providing technical assistance related to the application of the OEF Guide,
- provide explanations and support on specific steps of the OEFSR development process,
- provide specific training sessions during the EF pilot phase,
- manage the virtual consultation Forum.

6.1.5 The EF consultation forum

A dedicated website (wiki pages) has been created and it will be maintained during the whole duration of the Environmental Footprint (EF) pilot phase. It is available at: https://webgate.ec.europa.eu/fpfis/wikis/display/EUENVFP/.

The EF virtual consultation Forum is the location where all documents related to the PEF/OEF pilot category rules/sectoral rules are stored, where each consultation step is carried out, where the periodic communication on the pilots' advancements are taking place. A separate working space is available for each OEFSR pilot.

The virtual consultation Forum is managed by the Commission with the active involvement of the EF Technical Helpdesk and each Technical Secretariat.

6.2 Stakeholders involved in OEFSR development

The process of developing OEFSRs shall be open and transparent and shall include an open consultative format with relevant stakeholders.

The stakeholders should be involved following a supply chain approach. The relevant stakeholders for an OEFSR may include, but are not limited to, material suppliers, manufacturers, trade associations, purchasers, users, consumers, government representatives, non-governmental organizations (NGOs), public agencies and, when relevant, independent parties and certification bodies.

6.3 OEFSR scope definition

The granularity of scope and the representative organisation(s) (ROs) are key decisions that shall be identified and transparently justified in the scope of the OEFSR. First the scope of the sector shall be defined, and afterwards the corresponding NACE codes shall be identified.

The OEFSR shall include a sector definition, a description of the product portfolio (PP), the granularity of scope and the representative organisation(s) (RO). The PP refers to the amount and nature of goods and services provided by the company, corporation, firm, enterprise, authority or institution (also defined as organisation) over a specified reporting interval. The PP elements that are not covered by the OEFSR shall be clearly listed (as a clarification when sectors are similar).

- In case of a clearly defined and homogeneous PP, a single RO would be typically used.
- In case of a wide PP with different products/services or significantly different production routes for a similar PP, the definition of sub-PP is appropriate. In this case, different ROs might need to be established at sub-PP level. The OEFSR shall clearly specify what is the approach followed and what is the justification for it.

The scope of the OEFSR and thus RO shall include (i) all facilities and associated processes that are fully or partially owned and/or operated by the organisation and that directly contribute to the provision of the Product Portfolio during the reporting interval (also named 'organisational boundaries'), and (ii) all supply-chain stages from raw material acquisition through processing, production, distribution, storage, use and EOL treatment of the Product Portfolio (also named 'OEF boundaries'). See Figure 3.

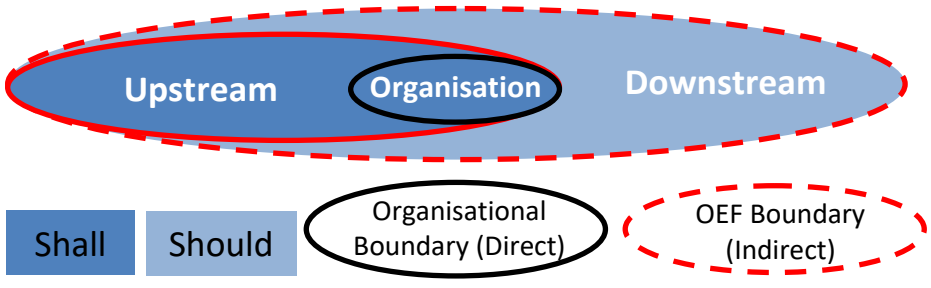

Figure 3. Organisational and OEF boundaries

The OEFSR shall specify the characteristic processes, activities and facilities of the sector of concern to be included in the Organisational boundaries and which to be excluded. It shall also specify the OEF boundary, including specification of the supply-chain stages to be included and the direct (gate-to-gate) and indirect (upstream and downstream) processes/activities (as also described in the representative organisation, see section 7.1). The OEFSR shall define the time span to be considered for the assessment and give justification if downstream (indirect) activities are excluded (e.g. use stage of intermediate products or products with an undeterminable fate). The OEFSR shall include a system boundary diagram covering the entire life cycle. All processes defined within the OEFSR boundaries shall be modelled by the applicant.

Once the scope has been finalised, the corresponding NACE codes shall be clearly listed. An important issue when defining the scope of sectors for creating OEFSRs is how to manage the consistency of OEFSRs of organisations that according to their NACE codes belong to a different sector, however have an overlap in parts of their Product Portfolio. For example, it shall be ensured that a manufacturer of leather and related products (NACE C15) and a manufacturer of wearing apparel (NACE C14, includes leather clothes) are using the same allocation rules as far as leather products are concerned. Such consistency shall be ensured by the Steering Committee with the support of the Technical Advisory Board.

6.4 Relationship between OEFSR as and PEFCRs

Typically, OEFSRs tend to be wider in scope than PEFCRs (e.g. relationship between textile sector and T-shirts). Furthermore, OEFSRs are considering some aspects that would tend to be out of the boundaries of a PEFCR study (e.g. impacts related to company services, such as marketing).

At the same time, there is a need to ensure consistency between the methodological choices made in correlated OEFSRs and PEFCRs. As stated in the OEF Guide, "in theory, the sum of the PEFs of the products provided by an organisation over a certain reporting interval (e.g. 1 year) should be close to its OEF for the same reporting interval."

In case there is an existing PEFCR covering a product/material/component in the PP, the related EF-compliant dataset already developed for that product/material/component shall be used for modelling that element in the PP.

6.5 The process of developing an OEFSR

The development of an OEFSR shall be based on an open and transparent consultation process involving all interested stakeholders. Reasonable efforts should be made to achieve a consensus throughout the process (ISO 14020:2000).

The inclusion of a virtual consultation and involvement process aids in ensuring that the opportunity exists for any and all stakeholders to contribute actively to the OEFSR development process or to provide comments regarding the OEFSR being developed, thus creating a development process which takes into account all relevant expertise with the utmost transparency.

6.5.1 Timing of the process

The OEFSR shall be finalised (including the approval of the Steering Committee) by the 20th of April 2018. OEFSRs shall be submitted to the Steering Committee for approval no later than the 19th of March 2018.

A final draft OEFSR missing one or more essential element (i.e. clear calculation rules or verification rules) or including requirements in conflict with the OEF method or the latest version of this Guidance document, may not be put forward for the final approval of the Steering Committee.

6.5.2 The consultation process

The Commission published the list of all OEFSRs under development[11].

Each Technical Secretariat shall identify and invite all the relevant stakeholders to participate in the OEFSR development by a virtual consultation process, and shall ensure that the role of the different stakeholders in the process is made clear and open to enable their participation.

Each Technical Secretariat shall create and maintain a log of those stakeholders that have been communicated with and responded to. A virtual consultation procedure shall be prepared in such a manner as to support the usage of an internet-based participatory process making use of the EF virtual consultation Forum.

An open internet-based consultation via the EF virtual consultation Forum serves the role of broadening the participation of stakeholders from different parts of the world. The use of the EF virtual consultation Forum also has the advantage that it facilitates participation from interested parties having difficulties to attend meetings, e.g. NGOs, SMEs, stakeholders from non-EU or developing countries and environmental groups.

Interested parties shall be given adequate time for review and access the details and sources of information used. The consultation process shall also ensure that interested parties who provide comments, will receive consideration of, and response to, their comments. In particular the Technical Secretariat should, at the end of each consultation period and in any case before opening the final consultation step, produce and make public in the EF virtual consultation Forum, a document describing the major comments received and how they have been addressed.

Virtual consultations and the period for commenting on documents shall last at least 4 calendar weeks.

6.5.3 Representativeness of an OEFSR

An OEFSR is considered to be representative of a sector when all the following conditions are met:

[11] This information is available at: http://ec.europa.eu/environment/eussd/smgp/product_footprint.htm

1. The Technical Secretariat in charge of a specific sector has invited to contribute to the OEFSR development process all the major competitors, or their representatives (i.e. via industry associations) covering for at least 75% of the EU market (in terms of yearly turnover or production). All companies contributing to more than 10% to the EU market (in terms of yearly turnover or production) have been invited.
2. The industry stakeholders (producers/importers, either as single companies and/or as business associations) participating to the whole process cover at least 51% of the EU market (in terms of yearly turnover or production). The participation of stakeholders will be judged on the basis of their inputs to the process and/or participation to meetings. The 51% target has to be achieved by the end of the pilot phase. This means that it is not a requirement for the Technical Secretariats themselves to fulfil.
3. The Technical secretariat has invited and involved in the OEFSR development process a wide range of stakeholders, with particular reference to SMEs, consumers' and environmental associations or their representatives.

In cases where all these conditions are not met by the time a final draft OEFSR is ready, the document will not be put forward to the final approval of the Steering Committee.

6.5.4 Structure of the OEFSR

The OEFSR shall follow the structure in Annex B to this guidance. Any deviation from the structure shall be justified and agreed with the Commission.

6.5.5 Procedure for the development of an OEFSR

There are a number of steps that shall be followed when preparing an OEFSR. Whilst the way to perform each step is under the technical responsibility of each Technical Secretariat, all steps shall be part of at least one consultation step with the relevant stakeholders.

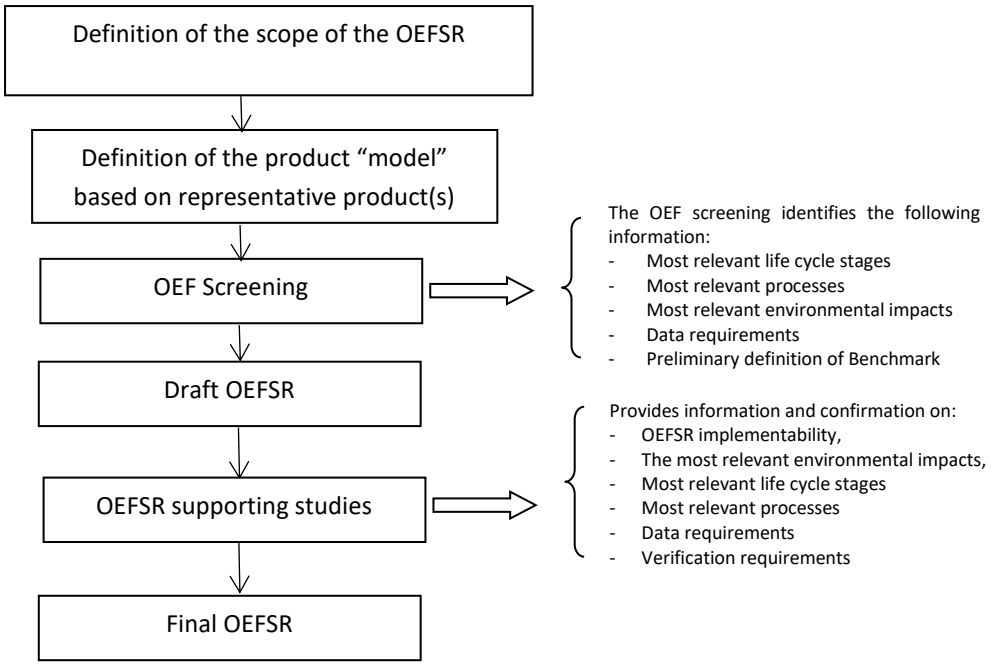

Figure 4: Steps to be followed for the development of OEFSRs.

One OEF screening and at least one OEFSR supporting study shall be performed per each sub-portfolio/representative organisation covered by the OEFSR.

6.5.6 Sector scope and classification

The OEFSR shall clearly state the sector(s) for which the OEFSR apply by using descriptive language. The OEFSR shall include a sector definition and a description of the Product Portfolio (PP). Pilot participants are encouraged to define a wide scope that can capture the typical PP in the sector (e.g. if typically bleaching textiles is part of the activities of wearing apparel manufacturers, both NACE codes 13 and 14 would be included). The same reporting unit (unit of analysis) shall apply to the sector. Once the scope has been finalised, the corresponding NACE codes shall be clearly listed. PP elements that are not covered by the OEFSR shall be clearly listed (as a clarification when sectors are similar).

In case of a clearly defined and homogeneous portfolio, a single representative organisation would be typically used.

In case of a wide portfolio with different products and services covered, the definition of sub-portfolios is appropriate. In this case, several representative organisations may be defined. The OEFSR shall clearly specify what is the approach followed and what is the justification for it.

In case separate sub-portfolios are defined with their corresponding representative organisations, at least one OEFSR supporting study shall be performed for each of the sub-portfolios.

6.5.7 The OEF screening

The OEF screening is necessary because it helps focussing data collection activities and data quality priorities for the OEFSR supporting study. The screening shall be carried out by the Technical Secretariat based on the "representative organisation" and in compliance with the procedure in chapter 7.4.

The objective of the screening is to pre-identify the following key information:

- Most relevant life cycle stages;
- Most relevant processes and elementary flows;
- Preliminary indication about the most relevant life cycle impact categories;
- Data quality needs;

The Technical Secretariat is encouraged to also perform the screening study by using top-down approaches, like for example Environmentally Extended Input Output (EEIO). In such cases, or for any alternative approach for screening proposed by the Technical Secretariat, a screening study shall also be done with the baseline approach as described in the OEF Guide) and the results of the two studies shall be compared.

The OEF screening can be based on readily available generic data (life cycle inventory databases, e.g. from commercial databases) fulfilling the data quality requirements as defined in the most updated version of the OEF Guide. In particular, for the screening step a minimum "fair" quality data rating is required for data contributing to at least 90% of the impact estimated for each EF impact category, as assessed via a qualitative expert judgement. In an iterative approach with communication and feedback from the Technical Secretariat to all the participating stakeholders, the accuracy and representativeness of the model and data shall be improved. The model can be adjusted by introducing new processes/activities to be included. Generic data used in the first round can be replaced with specific data and other more representative (specific) databases along the process.

The results of the screening should be subject to sensitivity analysis and be also part of the OEFSR review process.

6.5.8 The screening report

Each Technical Secretariat shall send for review to the Commission a screening report and the "model" developed through an LCA software. The objective of this review is to support the work of the Technical Secretariats helping them to identify at an early stage any deviation from the requirements of included in the OEF Guide or in the most updated version of this OEFSR Guidance document.

The screening report shall contain following information:

- Definition of the functional unit and reference flow;
- Flow diagram for each life cycle stage with a clear link between all processes involved and one global system boundary diagram;

- Identification of the foreground and background data;
- For each life cycle stage, a table with all processes involved with a clear identification of the source of the Life Cycle Inventory and calculation of the reference flow for each process ;
- Assumption about the use, re-use (if appropriate) and end-of-life scenario including the way the CFF formula is applied;
- Treatment of any multi-functionality issues encountered in the OEF modelling activity;
- Results for each EF impact category with a split per life cycle stage.

In case the Commission identifies any relevant issue, it will address them bilaterally with the concerned Technical Secretariat. If there are divergent opinions that cannot be reconciled, the issue will be raised at Technical Advisory Board level and, if necessary at Steering Committee level.

The detailed screening report shall be considered confidential by the Commission, thus it will be shared only within the Commission EF Teams and any reviewer contracted to support this task.

The decision from a Technical Secretariat not to produce such report or to produce incomplete reports would imply the application of chapter 6.6.

The software model used for the screening should be released by each TS to the Commission and remain freely accessible to any user also after the pilot phase is concluded[12]. The Commission services will update the models by recalculating the results (including the benchmarks) based on the EF-compliant secondary datasets that will be tendered in the last part of the pilot phase (re-modelling).

6.5.9 The draft OEFSR

Based on the results of the OEF screening and the related consultation, the Technical Secretariat shall produce a draft OEFSR.

The draft OEFSR is the guiding document to carry out the OEFSR supporting studies. It shall be drafted according to the requirements included in the OEF Guide and the Template provided for this purpose.

In the draft OEFSR all impact categories shall be included (and therefore used in the OEFSR supporting study). The draft OEFSR shall be revised based on the results of the OEFSR supporting studies.

6.5.10 Documents to be submitted to the first consultation

The documents to be submitted to the first consultation are:

- OEF screening report, and
- First draft OEFSR (no data sources specified)

[12] Within the pilot phase the models will not be made available.

The OEF screening report, apart from the quantification of the screening results, shall include the following information:

- description of the supply chain (processes) and scenarios (upstream, downstream, transport),
- results of the sensitivity analysis on allocation options,
- where and why generic data are to be preferred to specific data in the foreground system (if relevant),
- the environmental impact category selection process,
- additional environmental information (if needed),
- data gaps,
- life cycle inventories and characterised results for the representative product (for each impact category and life cycle stage).

After the approval of the document by the Steering Committee, the Technical Secretariat shall upload on the Stakeholder Workspace of the EF Wiki a table analysing the results of the consultation (comments received and how they have been dealt with).

6.5.11 The OEFSR supporting studies

The Technical Secretariat shall encourage the participants/stakeholders to carry out at least 3 OEF studies (and at least one for each sub-category covered by the OEFSR) compliant with the latest version available of the OEF Guide, the latest version available of this Guidance at the time of starting the supporting study, and with any specific requirement included in the draft OEFSR[13], comprising however all environmental impact categories and having a full coverage in terms of life cycle stages and processes. These studies are referred hereafter as OEFSR supporting studies. They shall be based on existing products as currently sold in the European market. A template that should be followed for OEFSR supporting studies is available in Annex E. Even if the template is not followed, the OEFSR supporting study shall include all content included in the Annex E template.

OEFSR supporting studies as well as OEFF studies based on an OEFSR shall contain a reference to the OEFSR or the version of the related EF Guidance that they comply with.

The goal of the OEFSR supporting studies shall clearly state that it is done as supporting evidence to the OEFSR development and the intended audience. The studies should always be done under the assumption that their result would be used to contribute to the development of an OEFSR that could support comparisons or comparative assertions intended to be disclosed to the public.

The OEFSR supporting studies will be used to test the pertinence and implement ability of the draft OEFSR including, but not limited to, the identified most relevant environmental impacts, issues related to data collection and quality, verification requirements. For this reason, each OEFSR

[13] In case of conflicting requirements between the PEF Guide and this Guidance, the latter prevails over the former.

supporting study shall implement the procedures explained in chapters 7.4 and 7.19[14]. Moreover, the uncertainty analysis carried out on the results of the OEFSR supporting studies may contribute to the identification of appropriate performance classes (where relevant and appropriate).

The results of the supporting study (including confidential information) will be accessed only by the external verifiers, the OEFSR reviewers, and the EF Team in DG ENV and JRC IES. Otherwise it shall remain confidential, unless differently agreed by the company performing the study. The company performing the study can grant access to other stakeholders upon request.

Beside the confidential report (template in Annex E in its full version), a second report shall be produced that describes the main outcomes of the OEFSR supporting study without disclosing confidential information. For this, chapter 5.1 and 9 of the template can be removed from the report, while chapter 6 on the results can be replaced by a non-confidential summary. This second report will be made available to the Technical Secretariat, the Technical Advisory Board and the Steering Committee.

The second report (without confidential information) or a condensed version thereof can be used in the communication phase. For example, report or background information to a label.

The information included in the supporting study reports shall only be used for activities related to the implementation of the EF pilot phase in the period 2013-2018.

6.5.11.1 Identification of the most relevant impact categories

The identification of the most relevant impact categories shall be done according to the procedure explained in chapter 7.4.

6.5.12 Disclosure and communication

The references to communication included in this section are only valid during the environmental footprint pilot phase (2013-2018) and as part of the tests carried out by the pilots and the Commission on different communication vehicles.

The results of a PEF study carried out in compliance with the OEF Guide or, where existing, with a specific OEFSR, are called “OEF-Profile”. Whenever an OEFSR exists for a certain product category, then its requirements shall be fulfilled if the information included in the OEF-profile is meant to be used for communication purposes.

Each OEFSR shall specify the minimum list of processes that shall be covered by company-specific data. The purpose is to avoid that an applicant without access to any primary data is able to perform a PEF study and communicate it results by only applying default datasets. Each OEFSR shall define what is mandatory based on the relevance and the possibility to have access to primary data.

The OEF-profile could be communicated in different forms, depending on the typology of communication (B2B or B2C) and the objective of the communication. A description of some

[14] The implementation of the procedure in Annex E shall be guaranteed in at least 1 supporting study per pilot.

communication vehicles (non-exhaustive list) is provided in the background document for the testing of communication vehicles in the Environmental Footprint pilot phase[15].

For final products the pilots shall communicate at least on 3 impact categories among those identified in the OEFSR as "most relevant".

For intermediate products the pilots shall communicate on all impact categories identified in the OEFSR as "most relevant".

Independently from the vehicle chosen, when environmental footprint information is used for communication purposes, the results for all impact categories (characterised, normalised, and weighted) shall be available to the public through freely accessible information sources (e.g. website).

The chosen communication vehicles shall be tested at least by the companies carrying out the OEFSR supporting studies during the last phase of the pilot phase. The testing may be organised horizontally by the Technical Secretariat. The length of the testing period should be proportionate to the approach used. For a brick-and-mortar (real market) test it is suggested to run the test for at least 6 months. For focus groups or online tests a duration of 2-3 months is considered sufficient.

Communication shall be tested when the results of the supporting studies are available. More details about this element are available in e background document for the testing of communication vehicles in the Environmental Footprint pilot phase.

6.5.13 Verification of the OEFSR supporting studies

The OEFSR review and the independent verification of the supporting studies are two separate processes (for the OEFSR review see chapter 6.5.16).

The verification of the OEFSR supporting studies will be conducted before their public release. Due to limited resources available (the costs of the verifiers will be covered by the Commission), only about 1/3 of all supporting studies will be the object of verification. At least 1 OEFSR supporting study per each pilot will be verified. It will be the Commission to decide which supporting study will be verified, and inform the companies concerned directly.

The verifications will take place in several ways, for example by on-site checking, reviewing calculations, mass balance calculations, or cross-checks with other sources. Different approaches will be tested in order to identify the optimal balance between completeness of verification and costs.

The objectives of the verification are:

- To assess compliance of the OEFSR supporting study and its results with the OEF Guide, the latest version of this Guidance at the time when the supporting study was started, and the reference OEFSR;

[15] http://ec.europa.eu/environment/eussd/smgp/pdf/Comm_bgdoc_v1.1.pdf

- To verify the traceability and validity of the information/data, both primary data of the organisation carrying out the study or of its suppliers, and other forms of secondary data used in the supporting studies. This task might involve cross-check comparison of documents (e.g. invoices, bills of sale, etc.) both provided by the organisation producing the OEF profile and the suppliers. For the most relevant data it might also be required to perform on-site document checks and inspections at the place where the supplier is located.
- The presentation of environmental performance included in the OEF profile;
- Other additional environmental information included in the OEF profile, if any.

In verifying the underlying data of the life cycle inventory, the verifier will examine that:

- The unit processes are defined as specified in the reference OEFSR;
- The source of input and output data (that is, referenced literature, vendor-supplied databases, and LCI databases) used for a unit process/module of specified unit processes are at least of the quality requested in the reference OEFSR;
- All relevant information is documented for each unit process, i.e. being consistent and understandable to enable an independent evaluation of the relevance of the data in accordance to the reference OEFSR. In particular the verifier should check that any additional documentation of the LCA process data (sources, correspondence, traceable references to origin, and so forth) is provided, especially if this information influenced LCA process data selection;
- The Data Quality Requirements are met.

In case of existence of secondary data in the results which have been already verified according to rules in the OEF Guide, these shall not be subject for further verification regarding the criteria methodological consistency, completeness and uncertainty. However, the appropriateness of the use of these data for the specific product needs to be verified. This verifications needs to cover the aspects of time, geographical and technological representativeness of the secondary data for the use in the specific PEF profile.

In verifying the results from the impact assessment, the verifier shall check that the calculations are made in a correct way based on the life cycle inventory and recommended characterisation, normalisation and weighting factors.

With regard to checking information of the life cycle inventory, the verifier shall make use of sample checks for the unit processes/information modules/PEFCR modules to check their conformance to original data sources. The organisation shall provide the verifier with information about the underlying data and calculations carried out upon request.

Sample checks may preferably be carried out for those unit processes/information modules/PEFCR modules having a significant influence on the life cycle inventory, and randomly chosen unit processes/information modules/PEFCR modules.

When a large variety of products (e.g. series of products) are subject for verification, sampling methods for the LCA study shall be used. If a specific sampling method has been developed by an organisation, this method shall be verified by a third party verifier and specified in the OEF profile.

The results of the preparatory study on this issue[16] and the details of the verification approaches tested during the EF pilot phase are available here[17].

6.5.14 Competences of the verifier

Please refer to the OEF Guide, section 9.3. During the EF pilot phase, the verifier qualifications shall be considered as indicative only.

6.5.15 Time validity of the OEFSR

The validity of any OEFSR developed during the pilot phase is 31st December 2020.

6.5.16 The OEFSR review

The Technical Secretariat shall set up an independent third party review panel composed of a minimum of three members (i.e., a chair and two members) for the OEFSR review. The panel should comprise of at least one LCA expert (preferably with a background on the product category under consideration and product-related environmental aspects), one representative from NGOs, and one industry expert. One member shall be selected as the chair. The panel members shall not have conflicts of interests on branded products and cannot be members of the Technical Secretariat.

6.5.16.1 Reviewer qualifications

Please refer to the OEF Guide, section 9.3. During the EF pilot phase, the reviewer qualifications shall be considered as indicative only.

6.5.16.2 Procedure for review

With the assistance of the Technical Secretariat, the OEFSR Review Panel shall meet to discuss the OEFSR and perform its review. Comments shall be generated and may be general, editorial or technical. The general comments apply to overarching issues affecting the entire OEFSR whereas editorial and technical comments may apply to specific sections within the OEFSR.

Within a time period agreed upon by the OEFSR Review Panel and the Technical Secretariat not to exceed 30 days, the OEFSR Review panel shall meet to generate their comments that are compiled in the Review Report.

The Review Report shall be sent to the Technical Secretariat for their review and discussion. A copy of the report shall also be sent to the EF Pilot Steering Committee.

6.5.16.3 Review criteria

The reviewers shall investigate whether the OEFSR has been developed in accordance with the requirement provided in this Guidance and supports creation of credible and consistent OEF profiles. In addition, the following criteria shall also apply:

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[16] *Investigating options for different compliance systems for PEF and OEF declarations,* http://ec.europa.eu/environment/eussd/smgp/pdf/Compliance_finalreport.pdf

[17] http://ec.europa.eu/environment/eussd/smgp/ef_pilots.htm#verification

- The OEFSR is consistent with the guidelines provided in the OEF Guide and the latest version available of this Guidance and deviations are justified,
- Functional unit, allocation and calculation rules are adequate for the product category under consideration,
- Primary and secondary datasets used in the screening and the supporting studies are relevant, representative, and reliable,
- Selected LCIA indicators and additional environmental information are appropriate for the product category under consideration and the selection is done in accordance with the guidelines stated in this Guidance and the OEF Guide,
- Both LCA-based data and the additional environmental information prescribed by the OEFSR give a description of the significant environmental aspects associated with the product.

6.5.16.4 Review report

A review report should be drafted based on all the comments made by the review panel with proposal for changes.

6.5.16.5 Addressing reviewers' comments

The Technical Secretariat shall review the OEFSR Review Panel's comments/proposals and develop a response for each. Using the OEFSR Review Report, the Technical Secretariat generates responses that may include:

- Acceptance of the proposal: change draft OEFSR to reflect proposal,
- Acceptance of the proposal: change draft OEFSR with modification to original proposal,
- Supporting commentary why the Technical Secretariat did not agree with the proposal,
- Return to OEFSR Review Panel with further questions on the comments/proposals.

If any response by the Technical Secretariat is not accepted by the OEFSR Review Panel, then the review panel report and the response of the Technical Secretariat shall be sent to the EF Pilot Technical Advisory Board and to the Steering Committee and the issues will be resolved at that level.

6.5.17 Documents to be drafted before the final consultation

The Technical Secretariat shall submit the final draft of the OEFSR into the final consultation. This document should be drafted according to the template provided in Annex B.

The OEFSR shall be complete, with the exception of the following elements:

- Final list of secondary datasets to be used by the applicant. These will be available for the final OEFSR.

A table or report with changes based on the final consultation and the OEFSR review shall be included for the Technical Advisory Board and Steering Committee to prepare the examination of the documents.

After the approval of the document by the Steering Committee, the Technical Secretariat shall upload on the Stakeholder Workspace of the EF wiki a table analysing the results of the final consultation (comments received and how they have been dealt with).

6.5.18 Documents to be drafted before final approval by the SC

The OEFSR shall contain all elements required in the template in Annex B.

6.6 Conditions to close a pilot

A pilot can be closed due to one of the following circumstances:

a) It becomes evident during the process that the representativeness conditions (see 6.5.3) will not be achievable. In this case the decision to stop the pilot is taken by the Commission without further consultation with the Steering Committee.
b) In case relevant deviations from the methodological mandatory requirements foreseen in the OEF Guide or the most updated version of this Guidance document are identified by the Commission and not solved through a bilateral dialogue with the relevant pilots. In this case the Commission can propose to the Steering Committee to stop the work of the pilot till the requirements are met.

7 Technical specifications

7.1 Reporting unit and reference flow

Each OEFSR shall define the sector-specific reporting unit and reference flow.

For an OEF, the overarching function of an Organisation (in the most general sense) is the provision of goods and services over a specified reporting interval. Therefore, the reporting unit shall be defined using the 'organisational boundaries' (which is parallel to the concept of “functional unit” in a traditional LCA) with reference to the PP (used as reference flow). The reporting interval should be one year.

The OEFSR shall specify how the PP is defined, in particular with respect to “how well” and “how long”. It shall also define the reporting interval when this differs from one year, and justify the chosen interval.

The OEFSR shall request the applicant to define its organisation with reference to the product portfolio through its name, kind of goods and services produced, location of operation, and NACE codes.

Meaningful comparisons and comparative assertions between organisations operating in the same sector can only be made when the organisations have similar PP, as defined in the reporting unit of the OEFSR.

7.2 How to define the representative organisation

Once the scope and the reporting unit of the OEFSR has been agreed, the Technical Secretariat (TS) shall develop a “model” of the RO existing in the EU and belonging to the OEF sector at hand.

At least one representative organisation (RO) has to be defined for each OEFSR as it forms the basis for the modelling in the OEF screening. When within a sector the PP is varied or organisations differ considerably, several ROs may need to be identified. For example, the PP and production processes might differ significantly between micro enterprises and large companies operating in the same sector.

There are two options for defining the RO:

1. It could be a virtual (exemplary) organisation. The virtual organisation may be calculated based on EU sales-weighted characteristics of technologies/ production processes/ organisation types, using PP as a reference. There is a risk that the specificities of some technologies/ production processes/ organisation types are overlooked due to their small market share. At OEF screening level this shall be avoided as relevant processes for the sector might not be retained.
2. It could be a real organisation. A real organisation considered to be as close as possible to the average organisation on the EU market in the sector may be chosen as RO. Known variations may be explored through sensitivity analysis during the OEF screening.

When modelling the RO, the TS shall use processes disaggregated at level-1. The TS shall provide information about all the steps taken to define the RO model and report during the screening the information gathered, taking the most appropriate measures to preserve the confidentiality of data (if required). The "model" of the RO shall contain a representative sample of the PP. Lack of available data and low market shares shall not be used as an argument for certain exclusions.

Business data, gathered during the OEFSR development, could be of confidential nature because of competitive business aspects, intellectual property rights or similar legal restrictions. Such confidential data shall not be made public under any circumstances; this is under the full responsibility of the TS.

The TS should include the following elements to the extent possible within the definition of the RO:

- Description of the product portfolio (PP);
- A flow diagram (system boundary) covering the entire life cycle;
- Assumptions related to transportation systems;
- Assumptions related to use scenario (if relevant);
- Assumptions related to End-of-Life scenario, including recycling and recovery as relevant.

The RO as the basis of the OEF screening study aims at:

1) Identifying the most relevant impact categories, life cycle stages, processes and direct elementary flows;
2) Identify processes for which primary data are requested;
3) Facilitate the comparison between organisations that fall within the same OEFSR, where appropriate and feasible.

Box 1 - Overall recommendation regarding RO

The RO(s) should be established at a level where they enable an identification of most relevant life cycle stages, processes, direct elementary flows and environmental impact categories without creating a bias, e.g. by neglecting technologies or production processes which play a minor role in the market;

The RO(s) should be established at a level where they can potentially enable a meaningful comparison between the environmental performance of similar organisations delivering a similar PP;

Different ROs might need to be established at sub-portfolio level, if differences between PPs, technologies, production processes or organisations are wide;

Variation of the PP within the same RO shall be investigated as appropriate;

Different ROs should be kept separate;

If appropriate, an aggregation to a higher level can be conducted at a later stage.

7.3 List of EF impact categories, normalisation factors and weighting factors

The OEFSR shall list the 16 impact categories to be used to calculate the OEF profile, as listed in Table 1. Out of these 16 impact categories, the OEFSR shall list those that are most relevant for the sector in scope (see next chapter).

The three toxicity-related impact categories are temporarily excluded from the procedure to identify the most relevant impact categories, life cycle stages, processes and elementary flows. This decision will be reconsidered at the end of the transition phase (2020), after the finalisation of the ongoing work done in collaboration between the Commission and ECHA agency in Helsinki on developing new CF based with REACH data. An OEF study carried out in compliance with an OEFSR shall still calculate and include in the OEF report the characterised results for the three toxicity impact categories, but these results shall not be used for other communication purposes and are not taken into consideration for the identification of the most relevant life cycle stages, processes, and foreground direct elementary flows. If the TS decides to add toxicity as a most relevant IC and present toxicity related impact results in their OEFSR, this shall be done in an additional chapter named "Other impact results" (see OEFSR template) and the existing limitations of the underlying method shall be clearly mentioned.

Table 1. List of recommended models at midpoint, together with their indicator, unit and source. In red text: the differences compared to the OEF guide (2013)

Recommendation at midpoint					
Impact category	**Indicator**	**Unit**	**Recommended default LCIA method**	**Source of CFs**	**Robustness**
Climate change[18]	Radiative forcing as Global Warming Potential (GWP100)	kg $CO_{2\,eq}$	Baseline model of 100 years of the IPCC (based on IPCC 2013)	EC-JRC, 2017[19]	I
Ozone depletion	Ozone Depletion Potential (ODP)	kg CFC-11 $_{eq}$	Steady-state ODPs as in (WMO 1999)	EC-JRC, 2017	I
Human toxicity, cancer*	Comparative Toxic Unit for humans (CTU_h)	CTUh	USEtox model (Rosenbaum et al, 2008)	EC-JRC, 2017	III/interim
Human toxicity, non- cancer*	Comparative Toxic Unit for humans (CTU_h)	CTUh	USEtox model (Rosenbaum et al, 2008)	EC-JRC, 2017	III/interim
Particulate matter	Impact on human health	disease incidence	PM method recommended by UNEP	EC-JRC, 2017	I

[18] Three additional sub-indicators may be requested for reporting, depending on the OEFSR. The sub-indicators are further described in section 7.9.

[19] The full list of characterization factors (EC-JRC, 2017a) is available at this link http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml

Recommendation at midpoint					
Impact category	**Indicator**	**Unit**	**Recommended default LCIA method**	**Source of CFs**	**Robustness**
			(UNEP 2016)		
Ionising radiation, human health	Human exposure efficiency relative to U^{235}	kBq U^{235} eq	Human health effect model as developed by Dreicer et al. 1995 (Frischknecht et al, 2000)	EC-JRC, 2017	II
Photochemical ozone formation, human health	Tropospheric ozone concentration increase	kg NMVOC eq	LOTOS-EUROS (Van Zelm et al, 2008) as applied in ReCiPe 2008	EC-JRC, 2017	II
Acidification	Accumulated Exceedance (AE)	mol H^+ eq	Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)	EC-JRC, 2017	II
Eutrophication, terrestrial	Accumulated Exceedance (AE)	mol N eq	Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)	EC-JRC, 2017	II
Eutrophication, freshwater	Fraction of nutrients reaching freshwater end compartment (P)	kg P eq	EUTREND model (Struijs et al, 2009) as implemented in ReCiPe	EC-JRC, 2017	II
Eutrophication, marine	Fraction of nutrients reaching marine end compartment (N)	kg N eq	EUTREND model (Struijs et al, 2009) as implemented in ReCiPe	EC-JRC, 2017	II
Ecotoxicity, freshwater*	Comparative Toxic Unit for ecosystems (CTU_e)	CTUe	USEtox model, (Rosenbaum et al, 2008)	EC-JRC, 2017	III/interim
Land use	• Soil quality index[20] • Biotic production • Erosion resistance • Mechanical filtration • Groundwater replenishment	• Dimensionless (pt) • kg biotic production • kg soil • m^3 water • m^3 groundwater	Soil quality index based on LANCA (Beck et al. 2010 and Bos et al. 2016)	EC-JRC, 2017	III

[20] This index is the result of the aggregation, performed by JRC, of the 4 indicators provided by LANCA model as indicators for land use

Recommendation at midpoint					
Impact category	**Indicator**	**Unit**	**Recommended default LCIA method**	**Source of CFs**	**Robustness**
Water use[#]	User deprivation potential (deprivation-weighted water consumption)	m^3 world $_{eq}$	Available WAter REmaining (AWARE) as recommended by UNEP, 2016	EC-JRC, 2017	III
Resource use, minerals and metals[21]	Abiotic resource depletion (ADP ultimate reserves)	kg Sb $_{eq}$	CML 2002 (Guinée et al., 2002) and van Oers et al. 2002.		III
Resource use, fossils	Abiotic resource depletion – fossil fuels (ADP-fossil)[22]	MJ	CML 2002 (Guinée et al., 2002) and van Oers et al. 2002	EC-JRC, 2017	III

*Long-term emissions (occurring beyond 100 years) shall be excluded from the toxic impact categories. Toxicity emissions to this sub-compartment have a characterisation factor set to 0 in the EF LCIA (to ensure consistency). If included by the applicant in the LCI modelling, the sub-compartment 'unspecified (long-term)' shall be used.

[#]The results for water use might be overestimated and shall therefore be interpreted with caution. Some of the EF datasets tendered during the pilot phase and used in this PEFCR/OEFSR include inconsistencies in the regionalization and elementary flow implementations. This problem has nothing to do with the impact assessment method or the implementability of EF methods, but occurred during the technical development of some of the datasets. The PEFCR/OEFSR remains valid and usable. The affected EF datasets will be corrected by mid-2019. At that time it will be possible to review this PEFCR/OEFSR accordingly, if seen necessary.

The full list normalization factors, and weighting factors are in Annex A.

The full list of characterization factors (EC-JRC, 2017a) is available at this link http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml

[21] The indicator "biotic resource intensity" was initially recommended under the additional environmental information. It will be further worked upon and explored during the transition phase.

[22] In the ILCD flow list, and for the current recommendation, Uranium is included in the list of energy carriers, and it is measured in MJ.

7.4 Identification of most relevant impact categories, life cycle stages, processes and elementary flows

The identification of most relevant impact categories, life cycle stages, processes, direct elementary flows shall be based on the screening study.

There is an important operational difference between most relevant impact categories, and life cycle stages on one hand and most relevant processes, and direct elementary flows on the other. In particular, the most relevant impact categories and life cycle stages are mainly relevant in the context of the "communication" part of OEF. They might serve the purpose of "warning" an organisation about the area where they should focus their attention in order to look deeper on how to improve their environmental performance.

The identification of the most relevant processes and direct elementary flows is more important for the engineers/designers to identify actions for improving the overall footprint e.g. by-pass or change a process, further optimise a process, apply antipollution technology etc. This is in particular relevant for internal studies. However, and this is specific to the OEFSR development process, the identification of the most relevant processes and elementary flows has a key role in the decision process to identify data-related requirements (see section below on data quality requirements for further information).

7.4.1 Procedure to identify the most relevant impact categories

The identification of the most relevant impact categories shall be based on the normalised and weighted results of the final representative organisation. At last three relevant impact categories shall be considered. The most relevant impact categories shall be identified as all impact categories that cumulatively contribute to at least 80% of the total environmental impact (excluding toxicity related impact categories). This should start from the largest to the smallest contributions. The TS may add more impact categories to the list of the most relevant ones but none shall be deleted.

7.4.2 Procedure to identify the most relevant life cycle stages

The most relevant life cycle stages are the life cycle stages which together contribute to at least **80%** of any of the most relevant impact categories identified. This should start from the largest to the smallest contributions. The TS may add more life cycle stages to the list of the most relevant ones but none shall be deleted.

In order to guarantee a minimum level of harmonisation among different OEFSRs, the default life cycle stages presented in the OEFSR shall be as a minimum the following:

- Raw material acquisition and pre-processing (including production of parts and unspecific components);
- Production of PP;
- Distribution and storage;
- Use stage (if in scope);
- End-of-life (including product, recovery / recycling; if in scope).

The TS may decide to split or add additional LC stages if there are good reasons for and this shall be justified in the OEFSR. E.g., the LC stage 'Raw material acquisition and pre-processing' ay be split into 'Raw material acquisition', 'pre-processing' and 'raw materials supplier transport'.

If the use stage accounts for more than 50% of the total impact then the procedure shall be re-run by excluding the use stage. In this case, the list of most relevant life cycle stages shall be those selected through the latter procedure plus the use stage.

7.4.3 Procedure to identify the most relevant processes

Each most relevant impact category shall be further investigated to identify the most relevant processes used to model each life cycle stage. The processes shall be modelled as disaggregated at level-1. Similar/identical processes taking place in different life cycle stages (e.g. transportation) shall be accounted for separately. The identification of the most relevant processes shall be done according to Table 2 below.

Table 2. Criteria to select at which life cycle stage level to identify the most relevant processes

Contribution of the use stage to the total impact	Most relevant processes identified at the level of
≥ 50%	· Whole life cycle excluding use stage, and · Use stage
< 50%	· Whole life cycle

The most relevant processes are those that collectively contribute at least with 80**%** to any of the most relevant impact categories identified. The TS may add more processes to the list of the most relevant ones but none shall be delete.

In most cases, vertically aggregated datasets may be identified as representing relevant processes. In such cases it may not be obvious which process is responsible for contributing to an impact category. The metadata accompanying the data should be analysed by the TS and used to identify the most relevant processes. If this is not possible, the TS may decide whether to seek further disaggregated data or to treat the aggregated dataset as a process for the purposes of identifying relevance[23].

[23] In this last case, if an aggregated dataset is relevant, everything in it is automatically relevant

7.4.4 Procedure to identify the most relevant direct elementary flows

For each most relevant process, the identification of the most relevant direct elementary flows is important to define which direct emissions or resource use should be requested as company-specific data (i.e. the foreground elementary flows within the processes listed in the OEFSR as mandatory company-specific).

The most relevant direct elementary flows are defined as those direct elementary flows contributing cumulatively at least with **80%** to the total impact of the direct elementary flows of the process, for each most relevant impact category. The analysis shall be limited to the direct emissions of the level-1 disaggregated datasets. This means that the 80% cumulative contribution shall be calculated against the impact caused by the direct emissions only, and not against the total impact of the process. The TS may add more elementary flows to the list of the most relevant ones but none shall be delete.

During the pilot phase, this is excluded from the procedures and no most relevant direct elementary flows shall be identified. During the transition phase the inclusion of this procedure will be reconsidered.

7.4.5 Dealing with negative numbers

When identifying the percentage impact contribution for any life cycle stage, process or flow, it is important that absolute values are used (i.e. the minus sign is ignored). This allows the relevance of any credits (e.g., from recycling) to be identified. In case of flows with a negative impact score (i) you should consider those flows to have a plus sign, namely a positive score), (ii) the total impact score is set to 100% and (iv) the percentage impact contribution for any life cycle stage, process or flow is assessed to this new total.

7.4.6 Specific instructions about aggregating elementary flows

Metal resource flows are not specified per origin of ore type in the source files of the ILCD recommended methods. However, in several background databases, metal resource flows are differentiated (for example, Silver, Ag 4.6E-5%, Au 1.3E-4%, in ore, Silver, Ag 4.2E-3%, Au 1.1E-4%, in ore, Silver, Ag 2.1E-4%, Au 2.1E-4%, in ore, etc.). Therefore, the specified flows were added to the ILCD method in LCA software packages with the same characterization factors as for the unspecified metals. When doing a contribution analysis of the metal resource flows, the flows per metal (silver, copper, nickel, etc.) shall be aggregated

There are five different energy resource flows specified in the source files of the ILCD recommended methods (brown coal; 11.9 MJ/kg, crude oil; 42.3 MJ/kg, hard coal; 26.3 MJ/kg, natural gas; 44.1 MJ/kg, peat; 8.4 MJ/kg). However, in several background databases, fossil energy flows are specified with different calorific values (for example, Gas, natural, 46.8 MJ per kg, Gas, natural, 36.6 MJ per m3, Gas, natural, 35 MJ per m3, Gas, natural, 30.3 MJ per kg, etc.[24]). Therefore, the specified flows

[24] These different flows can appear due the inconsistency between different databases.

were added to the ILCD method in LCA software packages with characterization factors related to the factors in the original source, taking the different calorific value into account. When doing a contribution analysis of the energy resource flows the flows based on the 5 original flows (brown coal, crude oil, hard coal, natural gas and peat) shall be aggregated.

7.4.7 Conclusions

In Table 3 the requirements to define most relevant contributions are summarized.

Table 3. Summary of requirements to define most relevant contributions.

Item	At what level does relevance need to be identified?	Threshold
Most relevant impact categories	Normalised and weighted results	Impact categories cumulatively contributing at least 80% of the total environmental impact (excluding toxicity related impact categories)
Most relevant life cycle stages	For each most relevant impact category	All life cycle stages contributing cumulatively more than **80%** to that impact category
Most relevant processes	For each most relevant impact category	All processes contributing cumulatively more than **80%** to that impact category
Most relevant elementary flows (excluded for the pilot phase)	For each most relevant process and most relevant impact category	All direct elementary flows contributing cumulatively at least to 80% to the impact (caused by the direct elementary flows only)

7.4.8 Example

What follows is a fictitious example, not based on any specific OEF study results.

Most relevant Impact Categories

Table 4. Contribution of different impact categories based on normalised and weighted results

Impact category	Contribution to the total impact (%)	Contribution % (excluding toxicity impact categories)
Climate change	21.5	28.0
Ozone depletion	3.0	3.9
Human toxicity, cancer	8.3	-
Human toxicity, non-cancer	14.9	-
Particulate matter	0.1	0.1
Ionizing radiation, human health	0.5	0.7
Photochemical ozone formation, human health	2.4	3.1
Acidification	1.5	2.1
Eutrophication, terrestrial	1.0	1.3
Eutrophication, freshwater	1.0	1.3
Eutrophication, marine	0.1	0.1
Ecotoxicity, freshwater	0.1	-
Land use	14.3	18.6
Water use	18.6	24.2
Resource use, minerals and metals	6.7	8.8
Resource use, fossils	6.0	7.8

Based on the normalised and weighted results, and excluding the toxicity related impacts, the most relevant impact categories are: climate change, water use, land use, and resource use (minerals and metals and fossils) for a cumulative contribution of 87.4% of the total impact.

Most Relevant Life Cycle Stages

Table 5. Contribution of different life cycle stages to the climate change impact category (based on the characterised inventory results)

Life cycle stage	Contribution (%)
Raw material acquisition and pre-processing	42.1
Production of the main product	25.2
Product distribution and storage	16.4
Use stage	10.8
End-of-life	5.5

The three life cycle stages in orange will be the ones identified as "most relevant" for climate change as they are contributing to more than 80%. Ranking shall start from the highest contributors. This procedure shall be repeated for all the selected most relevant EF impact categories.

Most Relevant Processes

Table 6. Contribution of different processes to the climate change impact category (based on the characterised inventory results)

Life cycle stage	Unit process	Contribution (%)
Raw material acquisition and pre-processing	Process A	8.9
	Process B	41.4
Production of the main product	Process C	18.4
	Process D	2.8
Product distribution and storage	Process E	16.5
Use stage	Process F	5.9
End-of-life	Other processes	6.1

According to the proposed procedure the processes B, C and E shall be selected as “most relevant”. However, the TS could consider deciding that process D, even if only contributing to 2.8% (and therefore not contributing more than Process A which is not relevant) is considered as most relevant to their sector, maybe because is the one of those expected to be in situation 1 of the DNM. They may therefore decide to add that process to the list of the most relevant that therefore would become: Process **B**, **C**, **D** and **E**.

This procedure shall be repeated for all the selected most relevant impact categories.

Most Relevant direct elementary flows (excluded for the pilot phase)

Table 7. Example of impact assessment results - contribution of each elementary flow to a specific process (climate change, results expressed in kg $CO_{2\ eq}$).

Inventory flow	Substance 1	Substance 2	Substance 3	Substance 4	Substance 5	Total
Process B	1100	600	500	450	50	2700
Process C	300	250	20	30	430	1030
Process E	64	1	1	1	1	68
Total	1464	856	521	481	436	3798

Table 8. Most relevant direct elementary flows contributing to climate change (based on the inventory results before normalisation and weighting) – process level

Inventory flow	Substance 1	Substance 2	Substance 3	Substance 4	Substance 5	Total
Process B	41%	22%	19%	17%	2%	100%
Process C	29%	24%	2%	3%	42%	100%
Process E	94%	1%	1%	1%	1%	100%

In this case the OEFSR shall require the reporting of the direct emissions in orange for each of the three most relevant processes. This procedure shall be repeated for all the selected most relevant impact categories.

7.5 Sampling procedure

In some cases, a sampling procedure is needed by the applicant of an OEFSR in order to limit the data collection only to a representative sample of plants/farms etc. Examples of cases when the sampling procedure may be needed are in case multiple production sites are involved in the production of the same SKU. E.g., in case the same raw material/input material comes from multiple sites or in case the same process is outsourced to more than one subcontractor/supplier.

There exist different procedures to derive a representative sample. For OEFSRs a stratified sample shall be used, i.e. one that ensures that sub-populations (strata) of a given population are each adequately represented within the whole sample of a research study. With this type of sampling, it is guaranteed that subjects from each sub-population are included in the final sample, whereas simple random sampling does not ensure that sub-populations are represented equally or proportionately within the sample.

Using a stratified sample will always achieve greater precision than a simple random sample, provided that the sub-populations have been chosen so that the items of the same sub-population are as similar as possible in terms of the characteristics of interest. In addition, a stratified sample guarantees better coverage of the population. The researcher has control over the sub-populations that are included in the sample, whereas simple random sampling does not guarantee that sub-

populations (strata) of a given population are each adequately represented within the final sample. However, one main disadvantage of stratified sampling is that it can be difficult to identify appropriate sub-populations for a population.

The following procedure shall be applied in order to select a representative sample as a stratified sample:

1) define the population
2) define homogenous sub-populations (stratification)
3) define the sub-samples at sub-population level
4) define the sample for the population starting from the definition of sub-samples at sub-population level.

7.5.1 How to define homogenous sub-populations (stratification)

Stratification is the process of dividing members of the population into homogeneous subgroups (sub-populations) before sampling. The sub-populations should be mutually exclusive: every element in the population shall be assigned to only one sub-population.

Aspects at least to be taken into consideration in the identification of the sub-populations:

- Geographical distribution of sites
- Technologies/farming practices involved
- Production capacity of the companies/sites taken into consideration

Additional aspects to be taken into consideration may be added by the TS for a specific product category.

The number of sub-populations may be identified as:

$$Nsp = g * t * c \qquad \text{[Equation 1]}$$

- Nsp: number of sub-populations
- g : number of countries in which the sites/plants/farms are located
- t : number of technologies/farming practices
- c : number of classes of capacity of companies

In case additional aspects are taken into account, the number of sub-populations is calculated using the formula just provided and multiplying the result with the numbers of classes identified for each additional aspect (e.g., those sites which have an environmental management or reporting systems in place).

Example 1

Identify the number of sub-populations for the following population:

350 farmers located in the same region in Spain, all the farmers have more or less the same annual production and are characterized by the same harvestings techniques.

In this case:

- g=1 : all the farmers are located in the same country
- t=1 : all the framers are using the same harvesting techniques
- c=1 : the capacity of the companies is almost the same (i.e. the have the same annual production)

$$Nsp = g * t * c = 1 * 1 * 1 = 1$$

Only one sub-population may be identified that coincides with the population.

Example 2

350 farmers are distributed in three different countries (100 in Spain, 200 in France and 50 in Germany). There are two different harvesting techniques that are used that differ in a relevant way (Spain: 70 technique A, 30 technique B; France: 100 technique A, 100 technique B; Germany: 50 technique A). The capacity of the farmers in term of annual production varies between 10000t and 100000t. According to expert judgement/relevant literature, it has been estimated that farmers with an annual production lower than 50000t are completely different in terms of efficiency compared to the farmers with an annual production higher than 50000t. Two classes of companies are defined based on the annual production: class 1, if production is lower than 50000 and class 2, if production if higher than 50000. (Spain: 80 class 1, 20 class 2; France: 50 class 1, 150 class 2; Germany: 50 class 1). In Table 9 are included the details about the population.

Table 9. Identification of the sub-population for Example 2.

Sub-population	Country		Technology		Capacity	
1	Spain		Technique A		Class 1	50
		70				
2	Spain		Technique A		Class 2	20
		100				
3	Spain		Technique B		Class 1	30
		30				
4	Spain		Technique B		Class 2	0
5	France		Technique A		Class 1	20
		100				
6	France		Technique A		Class 2	80
		200				
7	France		Technique B		Class 1	30
		100				
8	France		Technique B		Class 2	70
9	Germany		Technique A		Class 1	50
		50		50		
10	Germany		Technique A		Class 2	0

11	Germany	Technique B	Class 1	0
12	Germany	Technique B	Class 2	0

In this case:

- g=3 : three countries
- t=2 : two different harvesting techniques are identified
- c=2 : two classes of production are identified

$$Nsp = g * t * c = 3 * 2 * 2 = 12$$

It is possible to identify maximum 12 sub-populations that are summarized in Table 10 :

Table 10. Summary of the sub-population for example 2.

Sub-population	Country	Technology	Capacity	Number of companies in the sub-population
1	Spain	Technique A	Class 1	50
2	Spain	Technique A	Class 2	20
3	Spain	Technique B	Class 1	30
4	Spain	Technique B	Class 2	0
5	France	Technique A	Class 1	20
6	France	Technique A	Class 2	80
7	France	Technique B	Class 1	30
8	France	Technique B	Class 2	70
9	Germany	Technique A	Class 1	50
10	Germany	Technique A	Class 2	0
11	Germany	Technique B	Class 1	0
12	Germany	Technique B	Class 2	0

7.5.2 How to define sub-sample size at sub-population level

Once the sub-populations have been identified, for each sub-population the size of sample shall be calculated (the sub-sample size). Two approaches are possible:

1) based on the total production of the sub-population
2) based on the number of sites/farms/plants involved in the sub-population

The chosen approach shall be specified in the OEFSR. The same approach shall be used for all the sub-populations selected.

7.5.2.1 First approach

In case the first approach is chosen the OEFSR shall establish the unit of measure for the production, if t, m^3, m^2, value). The OEFSR shall identify the percentage of production to be covered by each sub-population. The percentage of production to be covered by each sub-population shall not be lower than 50%, expressed in the relevant unit. This percentage determines the sample size within the sub-population.

7.5.2.2 Second approach

In case the second approach is chosen:

The required sub-sample size shall calculated using the square root of the sub-population size.

$$n_{SS} = \sqrt{n_{SP}} \qquad \text{[Equation 2]}$$

- n_{SS}: required sub-sample size
- n_{SP}: sub-population size

Example

Table 11. Example – how to calculate the number of companies in each sub-sample.

Sub-population	Country	Technology	Capacity	Number of companies in the sub-population	Number of companies in the sample (sub-sample size, [n_{SS}])
1	Spain	Technique A	Class 1	50	7
2	Spain	Technique A	Class 2	20	5
3	Spain	Technique B	Class 1	30	6
4	Spain	Technique B	Class 2	0	0
5	France	Technique A	Class 1	20	5
6	France	Technique A	Class 2	80	9
7	France	Technique B	Class 1	30	6
8	France	Technique B	Class 2	70	8

9	Germany	Technique A	Class 1	50	7
10	Germany	Technique A	Class 2	0	0
11	Germany	Technique B	Class 1	0	0
12	Germany	Technique B	Class 2	0	0

7.5.3 How to define the sample for the population starting from the definition of sub-samples at sub-population level.

The representative sample of the population corresponds to the sum of the sub-samples at sub-population level.

7.5.4 What to do in case rounding is necessary

In case rounding is necessary, the general rule used in mathematics shall be applied:

- If the number you are rounding is followed by 5, 6, 7, 8, or 9, round the number up.
- If the number you are rounding is followed by 0, 1, 2, 3, or 4, round the number down.

7.5.5 Requirements for the OEFSR

The TS shall decide if sampling is allowed or not allowed in its OEFSR. The TS may explicitly prohibit the use of sampling procedures in the OEFSR, in this case sampling won't be allowed for OEF studies. If the TS allows sampling, the OEFSR shall contain a sentence like: "In case sampling is needed, it shall be conducted as specified in this OEFSR. However, sampling is not mandatory and any applicant of this OEFSR may decide to collect the data from all the plants or farms, without performing any sampling".

In case the OEFSR allows the use of sampling in OEF studies, the OEFSR shall:

- list the aspect to be taken into consideration in the selection of the sample for data collection;
- identify and list aspects that shall be taken into consideration when identifying the sub-populations, in addition to the three proposed by default in this document (if appropriate);
- identify which of the two approaches shall be used to define the size of sub-samples at sub-population level in case the applicant needs a sampling procedure, if the approach based on the total production of the sub-population of the approach based on the number of sites/farms/plants involved in the sub-population;
- in case approach 1) is chosen, define the percentage of representativeness and how this percentage shall be calculated by the applicant of the OEFSR. The percentage shall not be lower than the minimum identified in this document, e.g. 50% of the production;
- the OEFSR shall define the requirements for reporting by the user of the OEFSR. Description of the population and of the selected sample used for the EF study shall be clearly described

in the EF report. E.g., the % of the total production or % of number of sites, following the requirements stated in the OEFSR.

7.6 Cut-Off

Any cut-off should be avoided in the screening study and supporting studies. However, based on the results of the screening study and if confirmed by the supporting study results, the OEFSR may identify and list the processes excluded from the modelling by applying the following rule:

- In case processes are excluded from the model this shall be done based on a 1% cut-off for all impact categories based on environmental significance, additionally to the cut-off already included in the background datasets. This rule is valid for both intermediate and final products. To calculate a 1% cut-off, order the processes starting from the less relevant to the most relevant one. The processes that in total account less than 1% of the environmental impact for each impact category may be excluded from OEF studies (starting from the less relevant). In case the pilot decides to apply the cut-off rule, the OEFSR shall list the processes that may be excluded based on the cut-off.
- Human toxicity-Cancer, Human toxicity-non Cancer and Freshwater Ecotoxicity shall not be taken into account when selecting processes that may be excluded based on the cut-off rule. In other words, it means that if a process accounts for less than 1% for all the impact categories with the only exception of toxicity-related ICs, this process may be cut-off.

- In case the processes identified following this procedure starting from the results of the screening study are not confirmed by the supporting studies, these may not be excluded based on the cut-off rule.

Only the processes identified following this procedure starting from the results of the screening study and confirmed by the supporting studies may be listed in the OEFSR and excluded according to the cut off rule. No additional cut-offs are allowed for OEF studies in addition to those listed in the OEFSR.

7.7 Handling multi-functional processes

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 shall be partitioned between the product of interest and the other co-products in a principled manner. Systems involving multi-functionality of processes shall be modelled in accordance with the following decision hierarchy, with additional guidance provided by OEFSRs if available. However, for electricity use (see section 7.13), activities at farm (see section 7.10), and activities at slaughterhouse (see section 7.11) the allocation approach to be used shall be the one described in the respective section.

Decision hierarchy

I) Subdivision or system expansion

Wherever possible, subdivision or system expansion should be used to avoid allocation. Subdivision refers to disaggregating multifunctional processes or facilities to isolate the input flows directly associated with each process or facility output. System expansion refers to expanding the system by including additional functions related to the co-products. It shall be investigated first whether the analysed process can be subdivided or expanded. Where subdivision is possible, inventory data should be collected only for those unit processes[25] directly attributable[26] to the goods/services of concern. Or if the system can be expanded, the additional functions shall be included in the analysis with results communicated for the expanded system as a whole rather than on an individual co-product level.

II) Allocation based on a relevant underlying physical relationship

Where subdivision or system expansion cannot be applied, allocation should be applied: the inputs and outputs of the system should be partitioned between its different products or functions in a way that reflects relevant underlying physical relationships between them. (ISO 14044:2006, 14)

Allocation based on a relevant underlying physical relationship refers to partitioning the input and output flows of a multi-functional process or facility 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). Allocation based on a physical relationship can be modelled using direct substitution if a product can be identified that is directly substituted[27].

Can a direct substitution-effect be robustly modelled? This can be demonstrated by proving that (1) there is a direct, empirically demonstrable substitution effect, AND (2) the substituted product can be modelled and the resource use and emissions profile data subtracted in a directly representative manner: If yes (i.e. both conditions are verified), model the substitution effect.

Or

Can input/output flows be allocated based on some other relevant underlying physical relationship that relates the inputs and outputs to the function provided by the system? This can be demonstrated by proving that a relevant physical relationship can be defined by which to allocate the flows attributable to the provision of the defined function of the product system[28]: If yes, allocate based on this physical relationship.

III) Allocation Based on Some Other Relationship

[25] A unit process is the smallest element considered in the Resource Use and Emissions Profile for which input and output data are quantified. (based on ISO 14040:2006)

[26] Directly attributable refers to a process, activity or impact occurring within the defined system boundary.

[27] See below for an example of direct substitution.

[28] A product system is the collection of unit processes with elementary and product flows, performing one or more defined functions, and which models the life cycle of a product (ISO 14040:2006)

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 and II) are not possible. In any case, a clear justification for having discarded I and II and for having selected a certain allocation rule in step III shall be provided, to ensure the physical representativeness of the OEF results as far as possible.

Allocation based on some other relationship can be approached in one of the following alternative ways:

Can an indirect substitution[29] effect be identified? AND can the substituted product be modelled and the inventory subtracted in a reasonably representative manner? If yes (i.e. both conditions are verified), model the indirect substitution effect.

Or

Can the input/output flows be allocated between the products and functions on the basis of some other relationship (e.g. the relative economic value of the co-products)? If yes, allocate products and functions on the basis of the identified relationship

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 Circular Footprint Formula (see section 7.18) provides an approach that shall be used to estimate the overall emissions associated to a certain process involving recycling and/or energy recovery. These moreover also relate to waste flows generated within the system boundaries.

The OEFSR shall further specify multi-functionality solutions for application within the defined system boundaries and, where appropriate, for upstream and downstream stages. If feasible/appropriate, the OEFSR may further provide specific factors to be used in the case of allocation solutions. All such multi-functionality solutions specified in the OEFSR shall be clearly justified with reference to the OEF multi-functionality solution hierarchy.

- Where subdivision is applied, the OEFSR shall specify which processes are to be sub-divided and the principles that such subdivision should adhere to.
- Where allocation by physical relationship is applied, the OEFSR shall specify the relevant underlying physical relationships to be considered and list allocation values (which shall be fixed for all studies applying the OEFSR).
- Where allocation by some other relationship is applied, the OEFSR shall specify this relationship and list the allocation values (which shall be fixed for all studies applying the OEFSR).

[29] Indirect substitution occurs when a product is substituted but you don't know by which products exactly.

7.8 Extended product lifetime

Extended product lifetime, due to reuse or refurbishment of a product, can be split into two situations:

1. Into a product with original product specifications (providing the same function)
2. Into a product with different product specifications (providing another function)

In situation 1, the product lifetime is extended into a product with original product specifications (providing the same function) and shall be included in the FU and reference flow. The OEFSR shall describe how reuse or refurbishment is included in the calculations of the reference flow and full life cycle model, taking into account the "how long" of the FU. Default values for extended lifetime shall be provided in the OEFSR or shall be listed as mandatory company-specific information to be collected.

In situation 2, the reuse/refurbishment of a product results into a product with different product specifications (providing another function). This shall be considered as part of the CFF, as a form of recycling (see section 7.18.15.8). Also, old parts that have been changed during refurbishment shall be modelled under the CFF.

7.8.1 Reuse rates

Reuse rate is the number of times a material is used at the factory. This is often also called trip rates, reuse time or number of rotations. This may be expressed as the absolute number of reuse or as % of reuse rate. For example: a reuse rate of 80% equals 5 reuses. Equation 3 describes the conversion:

$$\text{Number of reuse} = \frac{1}{100\% - \%\ reuse\ rate} \qquad \text{[Equation 3]}$$

The number of reuse applied here refers to the total number of uses during the life of the material. It includes both the first use and all the following reuses.

Specific calculation rules for reusable packaging as well as average reuse rates for company or third-party operated packaging pools can be found in section 7.16.2.

7.8.2 How to apply 'reuse rate' (situation 1)

The number of times a material is reused affects the environmental profile of the product at different life cycle stages. The following 5 steps explain how the different life cycle stages with reusable materials shall be modelled, using packaging as an example:

1) Raw material acquisition: The reuse rate determines the quantity of packaging material consumed per product sold. The raw material consumption shall be calculated by dividing the actual weight of the packaging by the number of times this packaging is reused. For example: A 1l glass bottle weights 600 grams and is reused 10 times. The raw material use per litre is 60 gram (= 600 gram per bottle / 10 reuses).

2) Transport from packaging manufacturer to the product factory (where the products are packed): The reuse rate determines the quantity of transport that is needed per product sold. The transport

impact shall be calculated by dividing the one-way trip impact by the number of times this packaging is reused. One way transport distances shall be provided by the OEFSR.

3) Transport from product factory to final client and back: additional to the transport needed to go to the client, the return transport shall also be taken into account. To model the total transport, section 7.14 on modelling transport shall be followed.

4) At product factory: once the empty packaging is returned to the product factory, energy and resource use shall be accounted for cleaning, repairing or refilling (if applicable).

5) Packaging End-of-Life: the reuse rate determines the quantity of packaging material (per product sold) to be treated at End-of-Life. The amount of packaging treated at End-of-Life shall be calculated by dividing the actual weight of the packaging by the number of times this packaging was reused.

7.9 Climate change modelling

The impact category 'climate change' covers three sub-categories:

1. Climate change – fossil
2. Climate change – biogenic
3. Climate change – land use and land transformation

To provide all necessary information for developing the OEFSR, the OEFSR screening study shall always calculate the three climate change sub-categories separately. If climate change is identified as a most-relevant impact category, the OEFSR shall (i) always request to report the total climate change as the sum of the three sub-categories, and (ii) shall request the reporting of the sub-categories 'Climate change - biogenic' and 'Climate change - land use and land transformation' separately if the screening study shows a contribution of more than 5%[30] each to the total score. The OEFSR shall clarify the reason for reporting or not reporting the two sub-categories.

The OEF guide indicates that credits from 'temporary carbon storage' are excluded. This means that emissions emitted within a limited amount of time after their uptake shall be counted for as emitted "now" and there is no discounting of emissions within that given time frame (also in line with ISO/TS14067). The term 'limited amount of time' is here defined as 100 years, in line with other guiding documents such as in ILCD handbook (JRC 2016) and PAS2050:2011. Therefore, biogenic carbon emitted later than 100 years after its uptake is considered as permanent carbon storage.

[30]For example, if 'Climate change - biogenic' contributes with 7% (using absolute values) to the total climate change impact and 'Climate change – land use and land transformation' contributes with 3% to the total climate change impact. In that case the Total climate change impact and the 'Climate change – biogenic' shall be reported. It is up to the TS to decide where and how to report the latter ('Climate change – biogenic').

7.9.1 Sub-category 1: Climate change – fossil

This category covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.). This impact category includes emissions from peat and calcination/carbonation of limestone.

Modelling requirements: The flows falling under this definition should be modelled consistently with the most updated EF list of elementary flows[31]. The names ending with '(fossil)' (e.g., 'carbon dioxide (fossil)'' and 'methane (fossil)') shall be used if available.

7.9.2 Sub-category 2: Climate change – biogenic

This sub-category covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood. Carbon exchanges from native forests[32] shall be modelled under sub-category 3 (including connected soil emissions, derived products or residues).

Modelling requirements: the flows falling under this definition shall be modelled consistently with the most updated ILCD list of elementary flows and using the flow names ending with '(biogenic)'. The allocation rules used for all other elementary flows shall also apply to model the biogenic carbon flows. A simplified modelling approach should be used where only those flows that influence the climate change impact results (namely biogenic methane emissions) are modelled. This option is often used by food LCAs as it avoids modelling human digestion while deriving eventually at a zero balance. The following rules apply:

i. Only the emission 'methane (biogenic)' is modelled
ii. No further biogenic emissions and uptakes from atmosphere are modelled
iii. When methane emissions can be both fossil or biogenic, the release of biogenic methane shall be modelled first and then the remaining fossil methane

In case all emissions and removals are modelled separately, note that the corresponding characterisation factors for biogenic CO_2 uptakes and emissions are set to zero. Complementary characterisation factors shall be applied in case these flows are to be used to calculate additional

[31] http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml

[32]Native forests – represents native or long-term, non-degraded forests. Definition adapted from table 8 in Annex V C(2010)3751 to Directive 2009/28/EC. In principle this definition excludes short term forests, degraded forests, managed forest, and forests with short-term or long-term rotations.

information. In that case, the OEFSR shall describe how the additional information shall be calculated and which complementary characterisation factors shall be applied.

For cradle to grave assessments of final products with a lifetime beyond 100 years, a carbon credit shall be modelled. For cradle to grave assessments of final products with a lifetime below 100 years, the carbon storage time is co-determined by the storage time in the forest system (at plant uptake). Annex I describes in detail how the carbon storage time shall be calculated in this case. This could be the case for example for olive trees or cork trees.

Carbon credits shall be modelled as an emission uptake as 'resource from air' using the elementary flow 'carbon dioxide (biogenic-100yr)'. Please note that any carbon credit shall be properly allocated among the different by-products the system delivered over the full timeframe. For example, in case cork plantations last for 300 years, the amount to carbon stored during 200 years may be credited but shall be allocated over the different products the cork plantation delivers. The OEFSR shall request concrete proof of these carbon storages in order to get the credits.

For intermediate products (cradle to gate) the lifetime of the final product is not known. Therefore, no carbon credits shall be modelled at this point in the life cycle. The biogenic carbon content at factory gate (physical content and allocated content) shall always be reported as 'additional technical information'.

7.9.3 Sub-category 3: Climate change – land use and land transformation

This sub-category accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions). For native forests, all related CO_2 emissions are included and modelled under this sub-category (including connected soil emissions, products derived from native forest[33] and residues), while their CO_2 uptake is excluded.

Modelling requirements: the flows falling under this definition shall be modelled consistently with the most updated ILCD list of elementary flows and using the flow names ending with '(land use change)'. Biogenic carbon uptakes and emissions have to be inventoried separately for each elementary flow.

For **land use change**: all carbon emissions and removals shall be modelled following the modelling guidelines of PAS 2050:2011 (BSI 2011) and the supplementary document PAS2050-1:2012 (BSI 2012) for horticultural products.

PAS 2050:2011 (BSI 2011): Large emissions of GHGs can result as a consequence of land use change. Removals as a direct result of land use change (and not as a result of long-term management practices) do not usually occur, although it is recognized that this could happen in specific circumstances. Examples of direct land use change are the conversion of land used for growing crops

[33] Following the instantaneous oxidation approach in IPCC 2013 (Chapter 2).

to industrial use or conversion from forestland to cropland. All forms of land use change that result in emissions or removals are to be included. Indirect land use change refers to such conversions of land use as a consequence of changes in land use elsewhere. While GHG emissions also arise from indirect land use change, the methods and data requirements for calculating these emissions are not fully developed. Therefore, the assessment of emissions arising from indirect land use change is not included.

The GHG emissions and removals arising from direct land use change shall be assessed for any input to the life cycle of a product originating from that land and shall be included in the assessment of GHG emissions. The emissions arising from the product shall be assessed on the basis of the default land use change values provided in PAS 2050:2011 Annex C, unless better data is available. For countries and land use changes not included in this annex, the emissions arising from the product shall be assessed using the included GHG emissions and removals occurring as a result of direct land use change in accordance with the relevant sections of the IPCC (2006). The assessment of the impact of land use change shall include all direct land use change occurring not more than 20 years, or a single harvest period, prior to undertaking the assessment (whichever is the longer). The total GHG emissions and removals arising from direct land use change over the period shall be included in the quantification of GHG emissions of products arising from this land on the basis of equal allocation to each year of the period[34].

1) Where it can be demonstrated that the land use change occurred more than 20 years prior to the assessment being carried out, no emissions from land use change should be included in the assessment.

2) Where the timing of land use change cannot be demonstrated to be more than 20 years, or a single harvest period, prior to making the assessment (whichever is the longer), it shall be assumed that the land use change occurred on 1 January of either:

- *the earliest year in which it can be demonstrated that the land use change had occurred; or*
- *on 1 January of the year in which the assessment of GHG emissions and removals is being carried out.*

The following hierarchy shall apply when determining the GHG emissions and removals arising from land use change occurring not more than 20 years or a single harvest period, prior to making the assessment (whichever is the longer):

1. *where the country of production is known and the previous land use is known, the GHG emissions and removals arising from land use change shall be those resulting from the change in land use from the previous land use to the current land use in that country (additional guidelines on the calculations can be found in PAS 2050-1:2012);*
2. *where the country of production is known, but the former land use is not known, the GHG emissions arising from land use change shall be the estimate of average emissions from the land use change for that crop in that country (additional guidelines on the calculations can be found in PAS 2050-1:2012);*

[34] In case of variability of production over the years , a mass allocation should be applied.

3. *where neither the country of production nor the former land use is known, the GHG emissions arising from land use change shall be the weighted average of the average land use change emissions of that commodity in the countries in which it is grown.*

Knowledge of the prior land use can be demonstrated using a number of sources of information, such as satellite imagery and land survey data. Where records are not available, local knowledge of prior land use can be used. Countries in which a crop is grown can be determined from import statistics, and a cut-off threshold of not less than 90% of the weight of imports may be applied. Data sources, location and timing of land use change associated with inputs to products shall be reported.

Intermediate products (cradle to gate) derived from native forest shall always report as meta-data (in the 'additional technical information' section of the OEF report) (i) their carbon content (physical content and allocated content) and (ii) that corresponding carbon emissions shall be modelled with '(land use change)' elementary flows.

For **soil carbon stock**: soil carbon emissions shall be included and modelled under this sub-category (e.g., from rice fields). Soil carbon emissions derived from aboveground residues (except from native forest) shall be modelled under sub-category 2, such as the application of non-native forest residues or straw. Soil carbon uptake (accumulation) shall be excluded from the footprint results as it is highly questionable how the long term uptakes (beyond 100 years) can be guaranteed in practice. For example, from grasslands or improved land management through tilling techniques or other management actions taken in relation to agricultural land. Soil carbon storage may be included in the OEFSR as additional environmental information when proof is provided. For example, when legislation has different modelling requirements for the sector, such as the EU greenhouse gas accounting directive from 2013 (Decision 529/2013/EU) which indicate carbon stock accounting.

7.9.4 Characterisation factors of methane, carbon dioxide and carbon monoxide

Within the current OEF method, the global warming potentials of the Third assessment report of IPCC (2007) are applied. The GWPs shall be updated using the Fifth assessment report of IPCC (2013), including climate-change carbon feedbacks for both CO_2 and non-CO_2 substances (following the UNEP/SETAC recommendations of the Pellston Workshop, January 2016). The values with feedbacks are applied to ensure consistency, as feedbacks are already included for CO_2. The GWPs of well-mixed GHGs can be found in chapter 8 of the Scientific basis report, Tables 8.7 and 8.SM.16. The GWPs for near term GHGs are not recommended for use due to their complexity and high uncertainty. Near term GHGs refer to substances that are not well-mixed once emitted to the atmosphere because of their very rapid decay (black carbon, organic carbon, nitrogen oxides, sulphur oxides, volatile organic compounds, and carbon monoxide).

The third assessment IPCC report (2007) estimated the global warming potential for methane at 25 for a time period of 100 years. This value factors in the indirect climate effects of methane emissions (such as the positive feedback on the methane lifetime and on the concentrations of ozone and stratospheric water vapour) but excludes the oxidation of methane into carbon dioxide. The Fifth assessment report of IPCC (2013) reports a global warming potential for methane at 34, still with the exclusion of methane oxidation into carbon dioxide and which is valid for biogenic methane only (IPCC 2013, Table 8.7). IPCC (2013) refers to Boucher et al. (2009) to add the methane oxidation for

fossil methane, resulting in a GWP of 36. The added value of +2 includes only a partial oxidation of methane into CO_2. Boucher et al. (2009), calculated an upper limit of +2.5 when considering that all methane is converted into CO_2 and up to +2.75 with a longer time horizon. Within the context of the environmental footprint a simple stoichiometric calculation is used to compensate the avoided CO_2 uptake within the released methane (+2.75). It can be discussed which correction factor should be applied, (i) +2 following IPCC, (ii) +2.5 following the upper margin of Boucher et al. (2009) for a time horizon of 100 years or (iii) +2.75 using the stoichiometric balance (all emissions happens "now"). The last approach is chosen, as a GWP of 36.75 reassures the same outcome between a detailed modelling (modelling all carbon uptakes and releases) and a simplified modelling approach (only modelling the CH_4 release). Within the EF context, the same result between a detailed modelling approach or the EF proposed simplified modelling approach is considered to be essential. This means that for fossil methane a GWP of 36.75 shall be used.

For biogenic carbon modelling the list of ILCD elementary flows and CFs presented in Table 12 shall be applied.

Table 12. CFs for climate change modelling, with carbon feedbacks (in CO_2-equivalents)

Substance	Compartment	GWP_{100}
Carbon dioxide (fossil)	Air emission	1
Methane (fossil)	Air emission	36.75
Carbon monoxide (fossil)	Air emission	1.57 [35]
Carbon dioxide (biogenic)	Resources from air	0
Carbon dioxide (biogenic-100yr)	Resources from air	-1
Carbon dioxide (biogenic)	Air emission	0
Methane (biogenic)	Air emission	34
Carbon monoxide (biogenic)	Air emission	0
Carbon dioxide (land use change)	Resources from air	-1
Carbon dioxide (land use change)	Air emission	1
Methane (land use change)	Air emission	36.75
Carbon monoxide (land use change)	Air emission	1.57

[35] The effects of near term climate forcers are uncertain and therefore excluded (following the UNEP/SETAC recommendations of the Pellston Workshop, January 2016). The GWP presented here represents only the effects from degradation of CO into CO_2 (stoichiometric calculation).

7.10 Agricultural modelling

If relevant, the OEFSR shall provide clear modelling guidelines for agricultural activities. The modelling guidelines in this chapter shall be followed by the OEFSRs. Any exception to these rules shall be agreed with the Commission before being implemented.

7.10.1 Handling multi-functional processes

The rules described in the LEAP Guideline shall be followed: 'Environmental performance of animal feeds supply chains (pages 36-43), FAO 2015, available at http://www.fao.org/partnerships/leap/publications/en/'.

7.10.2 Crop type specific and country-region-or-climate specific data

Use of crop type specific and country-region-or-climate specific data for yield, water and land use, land use change, fertiliser (artificial and organic) amount (N, P amount) and pesticide amount (per active ingredient), per hectare per year, should be used.

7.10.3 Averaging data

Cultivation data shall be collected over a period of time sufficient to provide an average assessment of the life cycle inventory associated with the inputs and outputs of cultivation that will offset fluctuations due to seasonal differences. This shall be undertaken as described in the LEAP guidelines[36], set out below:

- For annual crops, an assessment period of at least three years shall be used (to level out differences in crop yields related to fluctuations in growing conditions over the years such as climate, pests and diseases, et cetera). Where data covering a three-year period is not available i.e. due to starting up a new production system (e.g. new greenhouse, newly cleared land, shift to other crop), the assessment may be conducted over a shorter period, but shall be not less than 1 year. Crops/plants grown in greenhouses shall be considered as annual crops/plants, unless the cultivation cycle is significantly shorter than a year and another crop is cultivated consecutively within that year. Tomatoes, peppers and other crops which are cultivated and harvested over a longer period through the year are considered as annual crops.
- For perennial plants (including entire plants and edible portions of perennial plants) a steady state situation (i.e. where all development stages are proportionally represented in the studied time period) shall be assumed and a three-year period shall be used to estimate the inputs and outputs[37].

[36] Environmental performance of animal feeds supply chains, FAO 2015, available at http://www.fao.org/partnerships/leap/publications/en/.

[37] The underlying assumption in the cradle to gate life cycle inventory assessment of horticultural products is that the inputs and outputs of the cultivation are in a 'steady state', which means that all development stages of perennial crops (with different quantities of inputs and outputs) shall be proportionally represented in the

- Where the different stages in the cultivation cycle are known to be disproportional, a correction shall be made by adjusting the crop areas allocated to different development stages in proportion to the crop areas expected in a theoretical steady state. The application of such correction shall be justified and recorded. The life cycle inventory of perennial plants and crops shall not be undertaken until the production system actually yields output.
- For crops that are grown and harvested in less than one year (e.g. lettuce produced in 2 to 4 months) data shall be gathered in relation to the specific time period for production of a single crop, from at least three recent consecutive cycles. Averaging over three years can best be done by first gathering annual data and calculating the life cycle inventory per year and then determine the three years average.

7.10.4 Pesticides

Pesticide emissions shall be modelled as specific active ingredients. The USEtox life cycle impact assessment method has a build in multimedia fate model which simulates the fate of the pesticides starting from the different emission compartments. Therefore, default emission fractions to environmental emission compartments are needed in the LCI modelling (Rosenbaum et al., 2015). As temporary approach, the pesticides applied on the field shall be modelled as 90% emitted to the agricultural soil compartment, 9% emitted to air and 1% emitted to water (based on expert judgement due to current limitations[38]). More specific data might be used if available.

A robust model to assess the link between the amount applied on the field and the amount ending up in the emission compartment is still missing today. The PESTLCI model might fill in this gap in the future, but is currently still under testing.

7.10.5 Fertilisers

Fertiliser (and manure) emissions shall be differentiated per fertilizer type and cover as a minimum:

- NH_3, to air (from N-fertiliser application)
- N_2O, to air (direct and indirect) (from N-fertiliser application)
- CO_2, to air (from lime, urea and urea-compounds application)

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time period of cultivation that is studied. This approach gives the advantage that inputs and outputs of a relatively short period can be used for the calculation of the cradle-to-gate life cycle inventory from the perennial crop product. Studying all development stages of a horticultural perennial crop can have a lifespan of 30 years and more (e.g. in case of fruit and nut trees).

[38] Several databases consider a 100% emitted to soil out of simplification (e.g. Agribalyse and ecoinvent). It is recognized that emissions to freshwater and air do occur. However, emission fractions vary significantly depending on the type of pesticide, the geographical location, time of application and application technique (ranging from 0% to 100%). Especially the % emitted to water can be strongly debated, however, overall it seems that 1% indicates a reasonable average (e.g. WUR-Alterra 2016: Emissies landbouwbestrijdingsmiddelen). Please note that these are temporary values until future modelling fills this gap.

- NO_3, to water unspecified (leaching from N-fertiliser application)
- PO_4, to water unspecified or freshwater (leaching and run-off of soluble phosphate from P-fertiliser application)
- P, to water unspecified or freshwater (soil particles containing phosphorous, from P-fertiliser application).

The impact assessment model for freshwater eutrophication should start (i) when P leaves the agricultural field (run off) or (ii) from manure or fertiliser application on agricultural field. Within LCI modelling, the agricultural field (soil) is often seen as belonging to the technosphere and thus included in the LCI model. This aligns with approach (i) where the impact assessment model starts after run-off, i.e. when P leaves the agricultural field. Therefore, within the EF context, the LCI should be modelled as the amount of P emitted to water after run-off and the emission compartment 'water' shall be used. When this amount is not available, the LCI may be modelled as the amount of P applied on the agricultural field (through manure or fertilisers) and the emission compartment 'soil' shall be used. In this case, the run-off from soil to water is part of the impact assessment method and included in the CF for soil.

The impact assessment marine Eutrophication starts after N leaves the field (soil). Therefore, N emissions to soil shall not be modelled. The amount of emissions ending up in the different air and water compartments per amount of fertilisers applied on the field shall be modelled within the LCI. Nitrogen emissions shall be calculated from Nitrogen applications of the farmer on the field and excluding external sources (e.g. rain deposition). To avoid strong inconsistencies among different OEFSRs, within the EF context it is decided to fix a number of emission factors by following a simplified approach. For nitrogen based fertilisers, the Tier 1 emissions factors of IPCC 2006 (*Table 2-4)* should be used, as presented in Table 13. Note that the values provided shall not be used to compare different types of synthetic fertilizers. More detailed modelling shall be used for that. In case better data is available, a more comprehensive Nitrogen field model may be used by the OEFSR, provided (i) it covers at least the emissions requested above, (ii) N shall be balanced in inputs and outputs and (iii) it shall be described in a transparent way.

Table 13. Tier 1 emission factors of IPCC 2006 (modified).

Emission	Compartment	Value to be applied
N_2O (synthetic fertiliser and manure; direct and indirect)	Air	0.022 kg N_2O/ kg N fertilizer applied
NH_3 (synthetic fertiliser)	Air	kg NH_3= kg N * FracGASF= 1*0.1* (17/14)= 0.12 kg NH_3/ kg N fertilizer applied
NH_3 (manure)	Air	kg NH_3= kg N*FracGASF= 1*0.2* (17/14)= 0.24 kg NH_3/ kg N manure applied
NO_3- (synthetic fertiliser and manure)	Water	kg NO^{3-} = kg N*FracLEACH = 1*0.3*(62/14) = 1.33 kg NO^{3-}/ kg N applied

It is recognized that the above nitrogen field model has its limitations and shall be improved in the future. Therefore, any OEFSR developed within the EF transition phase (2018-2020) and which has agricultural modelling in scope shall test (as minimum) the following alternative approach:

The N-balance is calculated using the parameters in Table 14 and the formula below. The total NO_3-N emission to water is considered a variable and its total inventory shall be calculated as:

"Total NO_3-N emission to water" = "NO_3^- base loss" + "additional NO3-N emissions to water", with

"Additional NO_3-N emissions to water" = "N input with all fertilisers" + "N_2 fixation by crop" – "N-removal with the harvest" – "NH_3 emissions to air" – "N_2O emissions to air" – "N_2 emissions to air" -"NO_3^- base loss".

If in certain low-input schemes the value for "additional NO_3-N emissions to water" be negative, the value is to be set to "0". Moreover, in such cases the absolute value of the calculated "additional NO_3-N emissions to water" is to be inventoried as additional N-fertiliser input into the system, using the same combination of N-fertilisers as employed to the analysed crop. This serves to avoid regarding fertility-depleting schemes by capturing the N-depletion by the analysed crop that is assumed to lead to the need for additional fertiliser later on to keep the same soil fertility level.

Table 14. Alternative approach to nitrogen modelling

Emission	Compartment	Value to be applied
NO_3^- base loss (synthetic fertiliser and manure)	Water	kg NO_3^-= kg N*FracLEACH = 1*0.1*(62/14) = 0.44 kg NO_3^-/ kg N applied
N_2O (synthetic fertiliser and manure; direct and indirect)	Air	0.022 kg N_2O/ kg N fertilizer applied
NH_3 - Urea (synthetic fertiliser)	Air	kg NH_3= kg N * FracGASF= 1*0.15* (17/14)= 0.18 kg NH_3/ kg N fertilizer applied
NH_3 - Ammonium nitrate (synthetic fertiliser)	Air	kg NH_3= kg N * FracGASF= 1*0.1* (17/14)= 0.12 kg NH_3/ kg N fertilizer applied
NH_3 - others (synthetic fertiliser)	Air	kg NH_3= kg N * FracGASF= 1*0.02* (17/14)= 0.024 kg NH_3/ kg N fertilizer applied
NH_3 (manure)	Air	kg NH_3= kg N*FracGASF= 1*0.2* (17/14)= 0.24 kg NH_3/ kg N manure applied
N_2-fixation by crop		For crops with symbiotic N_2-fixation: the fixed amount is assumed to be identical to the N-content in the harvested crop
N_2	Air	0.09 kg N_2 / kg N applied

7.10.6 Heavy metal emissions

Heavy metal emissions from field inputs shall be modelled as emission to soil and/or leaching or erosion to water. The inventory to water shall specify the oxidation state of the metal (e.g., Cr^{+3}, Cr^{+6}). As crops assimilate part of the heavy metal emissions during their cultivation clarification is needed on how to model crops that act as a sink. Two different modelling approaches are allowed:

- The final fate of the heavy metals elementary flows are not further considered within the system boundary: the inventory does not account for the final emissions of the heavy metals and therefore shall not account for the uptake of heavy metals by the crop. For example, heavy metals in agricultural crops cultivated for human consumption end up in the plant. Within the EF context human consumption is not modelled, the final fate is not further modelled and the plant acts as a heavy metal sink. Therefore, the uptake of heavy metals by the crop shall not be modelled.
- The final fate (emission compartment) of the heavy metal elementary flows is considered within the system boundary: the inventory does account for the final emissions (release) of the heavy metals in the environment and therefore shall also account for the uptake of heavy metals by the crop. For example, heavy metals in agricultural crops cultivated for feed will mainly end up in the animal digestion and used as manure back on the field where the metals are released in the environment and their impacts are captured by the impact assessment methods. Therefore, the inventory of the agricultural stage shall account for the uptake of heavy metals by the crop. A limited amount ends up in the animal (=sink), which may be neglected for simplification.

7.10.7 Rice cultivation

Methane emissions from rice cultivation shall be included based on the calculation rules of IPCC (2006) (Volume 4, Chapter 5.5, page 44-53).

7.10.8 Peat soils

Drained peat soils shall include carbon dioxide emissions on the basis of a model that relates the drainage levels to annual carbon oxidation.

7.10.9 Other activities

The following activities shall be included in agricultural modelling, if applicable:

- Input of seed material (kg/ha),
- Input of peat to soil (kg/ha + C/N ratio),
- Input of lime (kg $CaCO_3$/ha, type),
- Machine use (hours, type) (to be included if there is high level of mechanisation),
- Input N from crop residues that stay on the field or are burned (kg residue + N content/ha). Including emissions from residues burning.

Drying and storage of products shall always be included, unless its exclusion is clearly justified in the OEFSR.

Unless it is clearly documented that operations are carried out manually, field operations shall be accounted for through total fuel consumption or through inputs of specific machinery, transports to/from the field, energy for irrigation, etc.

7.11 Cattle, sheep, goat, and pork modelling

DISCLAIMER: The content of section 7.11 is based on the best information made available during the pilot phase. This information will be used mainly to carry out the re-modelling step of the PEFCRs/OEFSRs developed in the context of the EF pilot phase (2013-2018).
It is acknowledged that there are wide margins for improvements both in terms of allocation approaches and underlying data. This work will be continued during the transition phase (2018-2020).

This section includes instructions on how to model issues related to farm, slaughterhouse and rendering modules for the animals involved in the pilot phase and namely cattle, pig, sheep and goat. In particular, instructions will be provided on:

1. Allocation of upstream burdens at farm level among outputs leaving the farm
2. Allocation of upstream burdens (linked to live animals) at slaughterhouse among outputs leaving the slaughterhouse.

7.11.1 Allocation within the farm module

At farm module, subdivision shall be used for processes that can be directly attributed to certain outputs (e.g. energy use and emissions related to milking processes). When the processes cannot be subdivided due to the lack of separate data or because technically impossible, the upstream burden, e.g. feed production, shall be allocated to farm outputs using a biophysical allocation method. Default values shall be provided for each type of animal and these default values shall be included in the /OEFSR and used by EF studies unless company-specific data are collected. The change of allocation factors is allowed only when company-specific data are collected and used for the farm module. In case generic data are used for the farm module, no change of allocation factors is allowed and the ones included in this document shall be used.

7.11.2 Allocation within the farm module for cattle

The IDF 2015[39] allocation method between milk, cull cows and surplus calves shall be used. Dead animals and all the products coming from dead animals shall be regarded as waste and the Circular Footprint Formula (CFF) shall be applied. In this case, however, the traceability of the products

[39] IDF 2015. A common carbon footprint approach for dairy sector: The IDF guide to standard life cycle assessment methodology. Bulletin of the International Dairy Federation 479/2015.

coming from dead animals shall be granted in order for this aspect to be taken into consideration into PEF studies.

Manure exported to another farm shall be considered as

- **Residual (default option):** when manure does not have an economic value at the farm gate, it is regarded as residual without allocation of an upstream burden. The emissions related to manure management up to farm gate are allocated to the other outputs of the farm where manure is produced.
- **Co-product**: when exported manure has economic value at farm gate, an economic allocation of the upstream burden shall be used for manure by using the relative economic value of manure compared to milk and live animals at the farm gate. Biophysical allocation based on IDF rules shall nevertheless be applied to allocate the remaining emissions between milk and live animals.
- **Manure as waste**: when manure is treated as waste (e.g. landfilled), the CFF shall be applied.

The allocation factor (AF) for milk shall be calculated using the following equation:

$$AF = 1 - 6.04 * \frac{M_{meat}}{M_{milk}}$$ [Equation 4]

Where M_{meat} is the mass of live weight of all animals sold including bull calves and culled mature animals per year and M_{milk} is the mass of fat and protein corrected milk (FPCM) sold per year (corrected to 4% fat and 3.3% protein). The constant 6.04 describes the causal relationship between the energy content in feed in relation to the milk and live weight of animals produced. The constant is determined based on a study that collected data from 536 US dairy farms[40]. Although based on US farms, IDF considers that the approach is applicable to the European farming systems.

The FPCM (corrected to 4% fat and 3.3% protein) shall be calculated by using the following formula:

$$FPCM\left(\frac{kg}{yr}\right) = Production\left(\frac{kg}{yr}\right) * (0.1226 * True\ Fat\ \% + 0.0776 * True\ Protein\ \% + 0.2534)$$

[Equation 5]

When a default value of 0.02 kg_{meat}/kg_{milk} for the ratio of live weight of animals and milk produced in Equation 4 is used, the equation yields default allocation factors of 12% to live weight of animals and 88% to milk (Table 15). These values shall be used as default values for allocating the upstream burdens to milk and live weight of animals for cattle when secondary datasets are used. When company-specific data are collected for the farming stage, the allocation factors shall be changed using the equations included in this section.

[40] Thoma et al. (2013). A biophysical approach to allocation of life cycle environmental burdens for fluid milk supply chain analysis. International Dairy Journal 31 (2013)

Table 15. Default allocation factors for cattle at farming.

Co-product	Allocation factor
Animals, live weight	12%
Milk	88%

7.11.3 Allocation within the farm module for the sheep and goat

A biophysical approach shall be used for the allocation of upstream burdens to the different co-products for sheep and goat. The 2006 IPPC guidelines for national greenhouse gas inventories[41] contain a model to calculate energy requirements that shall be used for sheep and, as a proxy, for goats. This model is applied in the present document.

Dead animals and all the products coming from dead animals shall be regarded as waste and the Circular Footprint Formula (CFF) shall be applied. In this case, however, the traceability of the products coming from dead animals shall be granted in order for this aspect to be taken into consideration into EF studies.

The use of the default allocation factors included in this document is mandatory whenever secondary datasets are used for the life cycle stage of farming for sheep and goat. If company specific data are used for this life cycle stage, then the calculation of the allocation factors with the company specific data shall be performed using the equations provided.

The allocation factors shall be calculated as follows[42]:

$$\%\ wool = \frac{[\text{Energy for wool } (NE_{wool})]}{[(\text{Energy for wool } (NE_{wool}) + \text{Energy for milk } (NE_l) + \text{Energy for meat } (NE_g)]} \quad \text{[Equation 6]}$$

$$\%\ milk = \frac{[\text{Energy for milk } (NE_l)]}{[(\text{Energy for wool } (NE_{wool}) + \text{Energy for milk } (NE_l) + \text{Energy for meat } (NE_g)]} \quad \text{[Equation 7]}$$

$$\%\ meat = \frac{[\text{Energy for meat } (NE_g)]}{[(\text{Energy for wool } (NE_{wool}) + \text{Energy for milk } (NE_l) + \text{Energy for meat } (NE_g)]} \quad \text{[Equation 8]}$$

For the calculation of energy for wool (NE_{wool}), energy for milk (NE_l) and energy for meat (NE_g) with company specific data, the equations included in IPPC[43] and reported below shall be used. In case

[41] Dong, H., Mangino, J., McAllister, T.A., Hatfield, J.L., Johnson, D.E., Lassey, K. R.,… Romanoskaya, A. (2006). Chapter 10 Emissions From Livestock And Manure Management. In H.S. Eggleston, L. Buendia, K. Miwa, T. Ngara & K. Tanabe (Eds.), 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Japan: IGES.

[42] The same naming as used in "Dong, H., Mangino, J., McAllister, T.A., Hatfield, J.L., Johnson, D.E., Lassey, K. R.,… Romanoskaya, A. (2006). Chapter 10 Emissions From Livestock And Manure Management. In H.S. Eggleston, L. Buendia, K. Miwa, T. Ngara & K. Tanabe (Eds.), 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Japan: IGES" is used.

secondary data are used instead, the default values for the allocation factors provided in this document shall be used.

Energy for wool, NE_{wool}

$$NE_{wool} = \frac{(EV_{wool} \cdot Production_{wool})}{365} \quad \text{[Equation 9]}$$

NE_{wool} = net energy required to produce wool, MJ day^{-1}
EV_{wool} = the energy value of each kg of wool produced (weighed after drying but before scouring), MJ kg^{-1}. A default value of 157 MJ kg^{-1} (NRC, 2007[44]) shall be used for this estimate.[45]
$Production_{wool}$ = annual wool production per sheep, kg yr^{-1}

Default values to be used for the calculation of NE_{wool} and the resulting net energy required are reported in Table 16.

Table 16. Default values to be used for the calculation of NEwool for sheep.

Parameter	Value	Source
EV_{wool} - sheep	157 MJ kg^{-1}	NRC, 2007
$Production_{wool}$ - sheep	7.121 kg	Average of the four values provided in Table 1 of "Application of LCA to sheep production systems: investigating co-production of wool and meat using case studies from major global producers. Wiedemann et al, Int J. of LCA 2015.
NE_{wool} - sheep	3.063 MJ/d	Calculated using Eq. 9
NE_{wool} - goat	2.784 MJ/d	Calculated from NE_{wool} – sheep using Eq. 12

[43] Dong, H., Mangino, J., McAllister, T.A., Hatfield, J.L., Johnson, D.E., Lassey, K. R.,… Romanoskaya, A. (2006). Chapter 10 Emissions From Livestock And Manure Management. In H.S. Eggleston, L. Buendia, K. Miwa, T. Ngara & K. Tanabe (Eds.), 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Japan: IGES

[44] NRC. 2007. Nutrient requirements of small ruminants: Sheep, goats, cervids, and new world camelids. National Research Council. Washington DC, National Academies Press.

[45] The default value of 24 MJ kg^{-1} originally included in the IPPC document has been modified into 157 MJ kg^{-1} following the indication of FAO - Greenhouse gas emissions and fossil energy demand from small ruminant supply chains Guidelines for quantification, draft for public review, 2014.

Energy for milk, NEl

$$NE_l = Milk \cdot EV_{milk}$$ [Equation 10]

NE_l = net energy for lactation, MJ day^{-1}
Milk = amount of milk produced, kg of milk day^{-1}
EV_{milk} = the net energy required to produce 1 kg of milk. A default value of 4.6 MJ/kg (AFRC, 1993) shall be used which corresponds to a milk fat content of 7% by weight.

Table 17. Default values to be used for the calculation of NEl for sheep.

Parameter	Value	Source
EV_{milk} - sheep	4.6 MJ kg^{-1}	AFRC, 1993
$Milk$ - sheep	2.08 kg/d	Estimated milk production 550 lbs of sheep milk per year (average value), milk production estimated for 120 days in one year.
NE_l - sheep	9.568 MJ/d	Calculated using Eq. 10
NE_l - goat	8.697 MJ/d	Calculated from NE_l – sheep using Eq. 12

Energy for meat, NE_g

$$NE_g = WG_{lamb} \cdot \frac{a+0.5b(BW_i+BW_f)}{365}$$ [Equation 11]

NE_g = net energy needed for growth, MJ day^{-1}
WG_{lamb} = the weight gain (BW_f – BW_i), kg yr^{-1}
BW_i = the live bodyweight at weaning, kg
BW_f = the live bodyweight at 1-year old or at slaughter (live-weight) if slaughtered prior to 1 year of age, kg
a, b = constants as described in Table 18.

Note that lambs will be weaned over a period of weeks as they supplement a milk diet with pasture feed or supplied feed. The time of weaning should be taken as the time at which they are dependent on milk for half their energy supply. The NE_g equation used for sheep includes two empirical constants (a and b) that vary by animal species/category (Table 18).

Table 18. Constants for use in calculating NEg for sheep[46].

Animal species/category	a (MJ kg^{-1})	b (MJ kg^{-2})
Intact males	2.5	0.35
Castrates	4.4	0.32
Females	2.1	0.45

In case company specific data are used for the farming stage, the allocation factors shall be recalculated. In this case, the parameter "a" and "b" shall be calculated as weighted average when more than one animal category is present.

Table 19. Default values to be used for the calculation of NEg for sheep.

Parameter	Value	Source
WG_{lamb} - sheep	26.2-15=11.2 kg	Calculated
BW_i - sheep	15 kg	It is assumed that the weaning happens at six weeks. Weight at six weeks read from Figure 1 in "A generic model of growth, energy metabolism and body composition for cattle and sheep", Johnson et al, 2015 – Journal of Animal Science.
BW_f - sheep	26.2 kg	Average of the values for weight at slaughter, sheep as provided in Appendix 5, Greenhouse gas emissions and fossil energy demand from small ruminant supply chains, FAO 2014.
a - sheep	3	Average of the three values provided in Table 18Table 18
b - sheep	0.37	Average of the three values

[46] This table corresponds to Table 10.6 in Dong, H., Mangino, J., McAllister, T.A., Hatfield, J.L., Johnson, D.E., Lassey, K. R.,… Romanoskaya, A. (2006). Chapter 10 Emissions From Livestock And Manure Management. In H.S. Eggleston, L. Buendia, K. Miwa, T. Ngara & K. Tanabe (Eds.), 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Japan: IGES.

Parameter	Value	Source
		provided in Table 18
NE_g - sheep	0.326 MJ/d	Calculated using Eq. 11
NE_g - goat	0.296 MJ/d	Calculated from NE_g – sheep using Eq. 12

The default allocation factors to be used in OEFSR and in EF studies for sheep and goat are reported in Table 20 together with the calculations. The same equations[47] and default values used for the calculation of the energy requirements for sheep are used for the calculation of the energy requirements for goats after application of a correction factor.

Net energy requirement, goat = [(goat weight) / (sheep weight)]$^{0.75}$ • Net energy requirement, sheep

Sheep weight: 64.8 kg, average of male and female sheep for different regions in the world, data from Appendix 5, Greenhouse gas emissions and fossil energy demand from small ruminant supply chains, FAO 2014.

Goat weight: 57.05 kg, average of male and female goats for different regions in the world, data from Appendix 5, Greenhouse gas emissions and fossil energy demand from small ruminant supply chains, FAO 2014.

Net energy requirement, goat = [(57.05) / (64.8)]$^{0.75}$ • Net energy requirement, sheep [Equation 12]

Table 20. Default allocation factors to be used in OEFSR and in EF studies for sheep and goat at farming stage.

	Sheep	Goat[48]
Allocation factor, meat	$\%\ meat = \frac{[(NE_g)]}{[(NE_{wool}) + (NE_l) + (NE_g)]}$ = 2.52%	2.51 %
Allocation factor, milk	$\%\ milk = \frac{[(NE_l)]}{[(NE_{wool}) + (NE_l) + (NE_g)]}$ = 73.84%	73.85%
Allocation factor, wool	$\%\ wool = \frac{[\ (NE_{wool})]}{[(NE_{wool}) + (NE_l) + (NE_g)]}$ = 23.64%	23.64%

[47] Page 10.24 of Dong, H., Mangino, J., McAllister, T.A., Hatfield, J.L., Johnson, D.E., Lassey, K. R.,… Romanoskaya, A. (2006). Chapter 10 Emissions From Livestock And Manure Management. In H.S. Eggleston, L. Buendia, K. Miwa, T. Ngara & K. Tanabe (Eds.), 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Japan: IGES

[48] Allocation factors for goat are calculated starting from the net energy requirements for goat estimated from the net energy requirements for sheep and considering: sheep weight= 64.8 kg and goat weight= 57.05 kg.

7.11.4 Allocation within the farm module for pig

Allocation at farming stage between piglets and sows shall be made applying economic allocation. The default allocation factors to be used are reported below (data from the meat screening study).

Table 21. Allocation at farming stage between piglets and sows

	Unit	Price	Allocation factors
Piglets	24.8 p	0.95 €/kg live weight	92.63%
Sow to slaughter	84.8 kg	40.80 €/pig	7.37%

7.11.5 Allocation within the slaughterhouse

Slaughterhouse and rendering processes produce multiple outputs going to the food and feed chain or to other non-food or feed value chains as the leather industry or chemical or energy recovery chains.

At the slaughterhouse and rendering module, subdivision shall be used for processes that can be directly attributed to certain outputs. When the processes cannot be subdivided, the remaining (e.g. excluding that already allocated to milk for milk producing system and/or to wool for wool producing system) upstream burden shall be allocated to slaughterhouse and rendering outputs using the economic allocation method. Default values for prices and mass fractions are provided for cattle, pigs and small ruminants (sheep, goat) and these default values shall be included in relevant OEFSR and used by OEF studies and OEF supporting studies. No change of allocation factors is allowed.

7.11.6 Allocation within the slaughterhouse for cattle

At the slaughterhouse the allocation factors are established for the categories reported in Table 22. If allocation factors to subdivide the impact of the carcass among the different cuts are desired, they shall be defined in the relevant OEFSR.

The by-products from slaughterhouse and rendering can be classified in three categories:

- **Category 1**: Risk materials, e.g. infected/contaminated animals or animal by-products
    - Disposal and use: incineration, co-incineration, landfill, used as biofuel for combustion, manufacture of derived products
- **Category 2**: Manure and digestive tract content, products of animal origin unfit for human consumption
    - Disposal and use: incineration, co-incineration, landfill, fertilisers, compost, biofuels, combustion, manufacture of derived products
- **Category 3**: Carcases and parts of animals slaughtered and which are fit for human consumption but are not intended for human consumption for commercial reasons, include skins and hides going for leather industry (note that hides and skins can also belong to other categories depending on the condition and nature that is determined by the accompanying sanitary documentation)

- Disposal and use: incineration, co-incineration, landfill, feed, pet food, fertilisers, compost, biofuels, combustion, manufacture of derived products (e.g. leather), oleo-chemicals and chemicals

The upstream burden to slaughterhouse and rendering outputs shall be allocated as follows:

- **Food grade materials**: product with allocation of an upstream burden
- **Cat 1 material**: default no allocation of upstream burdens as it is seen as animal by-product treated as waste according to the CFF
- **Cat 2 material**: default no allocation of upstream burdens as it is seen as animal by-product treated as waste according to the CFF
- **Cat 3 material going the same way as cat 1 and cat** 2 (for fat – to be burned, or bone and meat meal) and does not have an economic value at the slaughterhouse gate: default no allocation of upstream burdens as it is treated as waste according to the CFF
- **Cat 3 skins and hides** (unless they are classified as waste and/or following the same way as cat 1 and cat2): product with allocation of an upstream burden
- **Cat 3 materials, not included in previous categories**: product with allocation of an upstream burden

The default values in Table 22 shall be used in OEFSR, supporting studies and PEF studies. The change of allocation factors is not allowed.

Table 22. Economic allocation ratios for beef (data already included in the CMWG Report)

	Mass faction (F)	**Price (P)**	**Economic allocation (EA)**	**Allocation ratio* (AR)**
	%	€/kg	%	
a) Fresh meat and edible offal	49.0	3.00	92.9[49]	1.90
b) Food grade bones	8.0	0.19	1.0	0.12
c) Food grade fat	7.0	0.40	1.8	0.25
d) Cat. 3 slaughter by-products	7.0	0.18	0.8	0.11
e) Hides and skins	7.0	0.80	3.5	0.51
f) Cat 1/2 material and waste	22.0	0.00	0.0	0.00

*Allocation ratio (AR) have been calculated as 'Economic allocation' divided by 'Mass fraction'

Allocation ratios (AR) can be used to calculate the environmental impact of a unit of product by using Equation 13.

$$EI_i = EI_w * AR_i \quad \text{[Equation 13]}$$

Where, EI_i is the environmental impact per mass unit of product *i* , (*i* = a slaughterhouse output listed in Table 22), EIw is the environmental impact of the whole animal divided by live weight mass of the animal and AR_i is the allocation ratio for product *i* (calculated as economic value of *i* divided by mass fraction of i).

EI_w shall include upstream impacts, slaughterhouse impacts that cannot be directly attributed to any specific products and impacts of waste management. The default values for AR_i as shown in Table 22 shall be used for the EF studies to represent the European average situation.

7.11.7 Allocation within the slaughterhouse for pigs

The default values in Table 23 shall be used in OEFSR, supporting studies and EF studies dealing with allocation within the slaughterhouse for pigs. The change of allocation factors based on company-specific data is not allowed. The mass fractions and the prices are taken from the screening study provided by the meat pilot.

Table 23. Economic allocation ratios for pigs (from the meat screening study)

	Mass fraction (F)	**Price (P)**	**Economic allocation (EA)**	**Allocation ratio* (AR)**
	%	€/kg	%	
a) Fresh meat and edible offal	67.0[50]	1.08	98.67[51]	1.54
b) Food grade bones	11.0	0.03	0.47	0.04
c) Food grade fat	3.0	0.02	0.09	0.03
d) Cat. 3 slaughter by-products	19.0	0.03	0.77	0.04
e) Hides and skins (categorized in cat.3 products)	0.0	0.00	0	0
Total	100.0		100.0	

7.11.8 Allocation within the slaughterhouse for sheep and goat

The default values in Table 24 shall be used in OEFSR, supporting studies and PEF studies dealing with allocation within the slaughterhouse for sheep and goat. The change of allocation factors based on company-specific data is not allowed. The mass fractions and the prices are taken from the screening study made by the meat pilot. Until more reliable data on mass fractions and price for goats are made available, the same allocation factors for the sheep shall be used also for goat.

[50] The data in the screening do not sum up to 100%, but to 96%. We have recalculated the percentages to arrive at 100%. To be checked with the meat pilot what happened to the missing 4%

Table 24. Economic allocation ratios for sheep (from the meat screening study). The same allocation factors shall be used also for goat.

	Mass fraction (F)	Price (P)	Economic allocation (EA)	Allocation ratio* (AR)
	%	€/kg	%	
a) Fresh meat and edible offal	44.0	7	97.8[52]	2.22
b) Food grade bones	4.0	0.01	0.0127	0.0032
c) Food grade fat	6.0	0.01	0.0190	0.0032
d) Cat. 3 slaughter by-products	13.0	0.15	0.618	0.05
e) Hides and skins (categorized in cat.3 products)	14.0	0.35	1.6	0.11
f) cat ½ material and waste	19	0	0	0
	100		100	

7.12 Biodiversity

The current OEF impact assessment method includes no impact category named "biodiversity". However, the current OEF method includes at least 6 impact categories that have an effect on biodiversity (i.e., climate change, eutrophication aquatic freshwater, eutrophication aquatic marine, acidification, water use, land use). As biodiversity is an important topic on the political agenda, when developing an OEFSR, biodiversity shall be addressed separately (besides the EF impact categories) through the procedure below:

1. When performing the screening study the TS shall make an assessment about the relevance of biodiversity on the product group in scope of the OEFSR. This assessment shall be independent from the results of the OEF impact assessment method and clearly explained in a dedicated section of the screening.
2. The OEFSR shall clearly explain in the section on "EF impact assessment" whether biodiversity is considered relevant or not. If the TS determines that there are significant impacts on biodiversity, then they shall describe in this section of the OEFSR how biodiversity impacts shall be assessed and reported by the applicant. The biodiversity results shall be reported under "additional environmental information".

While the TS is free to determine how biodiversity shall be assessed and reported (if relevant), the following suggestions are offered:

- To express the (avoided) impact on biodiversity as the percentage of material that comes from ecosystems that have been managed to maintain or enhance conditions for biodiversity, as demonstrated by regular monitoring and reporting of biodiversity levels and gains or losses (e.g. less than 15% loss of species richness due to disturbance, but the pilots may set their own level provided this is well justified). The assessment should refer to materials that end up in the final products and to materials that have been used during the production process. For example, charcoal that is used in steel production processes, or soy that is used to feed cows that produce dairy etc.
- To report additionally the percentage of such materials for which no chain of custody or traceability information can be found.
- To use a certification system as a proxy. The TS shall determine which certification schemes provide sufficient evidence for ensuring biodiversity maintenance and describe the criteria used. A useful overview of standards can be found on http://www.standardsmap.org/.

7.13 Electricity modelling

The guidelines in this section shall only be used for those processes where company-specific information is collected (situation 1 / Option 1 & situation 2 / Option 1 of the Data Needs Matrix) and shall not be applied by OEFSRs that cover electricity as main product (e.g., on photovoltaic system).

7.13.1 General guidelines

In OEF studies the following electricity mix shall be used in hierarchical order:

(i) Supplier-specific electricity product[53] shall be used if:
  (a) available, and
  (b) the set of minimum criteria to ensure the contractual instruments are reliable is met.

(ii) The supplier-specific total electricity mix shall be used if:
  (a) available, and
  (b) the set of minimum criteria that to ensure the contractual instruments are reliable is met.

(iii) As a last option the 'country-specific residual grid mix, consumption mix' shall be used (available at http://lcdn.thinkstep.com/Node/). Country-specific means the country in which the life cycle stage occurs. This may be an EU country or non-EU country. The residual grid mix characterizes the unclaimed, untracked or publicly shared electricity. This prevents double counting with the use of supplier-specific electricity mixes in (i) and (ii).

Note: if for a country, there is a 100% tracking system in place, case (i) shall be applied.

[53] See. ISO 14067

The environmental integrity of the use of supplier-specific electricity mix depends on ensuring that contractual instruments (for tracking) **reliably and uniquely convey claims to consumers**. Without this, the OEF lacks the accuracy and consistency necessary to drive product/corporate electricity procurement decisions and accurate consumer (buyer of electricity) claims. Therefore, a set of minimum criteria that relate to the integrity of the contractual instruments as reliable conveyers of environmental footprint information has been identified. They represent the minimum features necessary to use supplier-specific mix within OEF studies.

7.13.2 Set of minimal criteria to ensure contractual instruments from suppliers

The OEFSR shall prescribe that a supplier-specific electricity product/mix may only be used when the applicant ensures that any contractual instrument meets the criteria specified below. If contractual instruments do not meet the criteria, then country-specific residual electricity consumption-mix shall be used in the modelling.

The proposed list of criteria below is based on the criteria from the GHG Protocol Scope 2 Guidance – An amendment to the GHG Protocol Corporate Standard – Mary Sotos – World Resource Institute (more explained in Table 25). A contractual instrument used for electricity modelling shall:

Criterion 1: Convey attributes

- Convey the energy type mix associated with the unit of electricity produced.
- The energy type mix shall be calculated based on delivered electricity, incorporating certificates sourced and retired on behalf of its customers. Electricity from facilities for which the attributes have been sold off (via contracts or certificates) shall be characterized as having the environmental attributes of the country residual consumption mix where the facility is located.

Criterion 2: Be a unique claim

- Be the only instruments that carry the environmental attribute claim associated with that quantity of electricity generated.
- Be tracked and redeemed, retired, or cancelled [2] by or on behalf of the company (e.g. by an audit of contracts, third-party certification, or may be handled automatically through other disclosure registries, systems, or mechanisms).

Criterion 3: Be as close as possible to the period to which the contractual instrument is applied

Table 25 gives guidance on how to fulfil each criterion.

Table 25. Minimal criteria to ensure contractual instruments from suppliers

Criterion 1	**CONVEY ENVIRONMENTAL ATTRIBUTES AND GIVE EXPLANATION ABOUT THE CALCULATION METHOD** • Convey the energy type mix (or other related environmental attributes) associated with the unit of electricity produced. • Give explanation about the calculation method used to determine this mix
Context	Each program or policy will establish their own eligibility criteria and the attributes to be

	conveyed. These criteria specify energy resource type and certain energy generation facility characteristics, such as type of technologies, facility ages, or facility locations (but differ from one program/policy to another one). These attributes specify the energy resource type and sometimes some energy generation facility characteristics.
Conditions for satisfying the criterion	1) Convey the energy mix: If there is no energy type mix specified in the contractual instruments, ask your supplier to receive this information or other environmental attributes (GHG emission rate…). If no answer is received, use the 'country-specific residual grid mix, consumption mix'. If an answer is received, go to step 2).
	2) Give explanation about the calculation method used: Ask your supplier to receive calculation method details in order to ensure he follow the above principle. If no information is received, apply the supplier-specific electricity mix, include the information received and document it was not possible to check for double counting.
Criterion 2	**UNIQUE CLAIMS** • Be the only instrument that carry the environmental attribute claim associated with that quantity of electricity generation. • Be tracked and redeemed, retired, or cancelled by or on behalf of the company (e.g. by an audit of contracts, third-party certification, or may be handled automatically through other disclosure registries, systems, or mechanisms).
Context	Certificates generally serve four main purposes, including[3] (i) supplier disclosure, (ii) supplier quotas for the delivery or sales of specific energy sources, (iii) tax exemption, (iv) voluntary consumer programs. Each program or policy will establish their own eligibility criteria. These criteria specify certain energy generation facility characteristics, such as type of technologies, facility ages, or facility locations (but differ from one program/policy to another one). Certificates must come from facilities meeting these criteria in order to be eligible for use in that program. In addition, individual country markets or policy-making bodies may accomplish these different functions using a single certificate system or a multi-certificate system.
Conditions for satisfying the criterion	1. Is the plant located in a country with no tracking system? Consult the following report – Table 2 : http://www.reliable-disclosure.org/upload/161-RE-DISS_2014_Residual_Mix_Results_2015-05-15_corrected2.pdf. - If yes, use the 'country-specific residual grid mix, consumption mix' - If no, go to the second question 2. Is the plant located in a country with a part of untracked consumption > 95%? - If yes, use the 'country-specific residual grid mix, consumption mix' as the best data available to approximate the residual consumption mix - If no, go to the third question 3. Is the plant located in a country with a single certificate system or a multi-certificate system? Consult the following report : https://ec.europa.eu/energy/intelligent/projects/en/projects/e-track-ii Then : - If the plant is located in a region/country with a single certificate system the unique claim criteria is met. Use energy type mix mentioned on the contractual instrument. - If the plant is located in a region/country with a multi-certificate system, the unique claim is not ensured. Contact the country-specific Issuing Body (The European organization which governs the European Energy Certificate System, http://www.aib-net.org) to identify if there is a need to ask for more than one contractual instrument(s) to be sure there is no risk of double counting: ○ If more than one contractual instruments is needed, request all contractual instruments at the supplier to avoid double counting ○ If it is not possible to avoid double counting, report this risk of double

	counting in the OEF report and use the 'country-specific residual grid mix, consumption mix'.
Criteria 3	**Be issued and redeemed as close as possible to the period of electricity consumption to which the contractual instrument is applied.**

7.13.3 How to model 'country-specific residual grid mix, consumption mix'

Datasets for residual grid mix, per energy type, per country and per voltage have been purchased by the European Commission and are available in the dedicated node (http://lcdn.thinkstep.com/Node/). In case the necessary dataset is not available, the alternative dataset shall be chosen according to the procedure described in section 7.19.5. If no dataset is available, the following approach may be used:

Determine the country consumption mix (e.g. X% of MWh produced with hydro energy, Y% of MWh produced with coal power plant) and combined them with LCI datasets per energy type and country/region (e.g. LCI dataset for the production of 1MWh hydro energy in Switzerland):

- Activity data related to non-EU country consumption mix per detailed energy type shall be determined based on:
  - Domestic production mix per production technologies
  - Import quantity and from which neighbouring countries
  - Transmission losses
  - Distribution losses
  - Type of fuel supply (share of resources used, by import and / or domestic supply)

  These data may be found in the publications of the International Energy Agency (IEA).

- Available LCI datasets per fuel technologies in the node. The LCI datasets available are generally specific to a country or a region in terms of:
  - fuel supply (share of resources used, by import and / or domestic supply),
  - energy carrier properties (e.g. element and energy contents)
  - technology standards of power plants regarding efficiency, firing technology, flue-gas desulphurisation, NOx removal and de-dusting.

7.13.4 A single location with multiple products and more than one electricity mix

How to proceed if only a part of the electricity use is covered by a supplier-specific mix or on-site electricity generation and how to attribute the electricity mix among products produced at the same location? Although we don't expect this to happen often within OEFSRs, the following procedure shall be followed: The subdivision of electricity supply used among multiple products is based on a physical relationship (e.g. number of pieces or kg of product). If the consumed electricity comes from more than one electricity mix, each mix source shall be used in terms of its proportion in the total kWh consumed. For example, if a fraction of this total kWh consumed is coming from a specific supplier a supplier-specific electricity mix shall be used for this part. See below for on-site electricity use.

A specific electricity type may be allocated to one specific product portfolio in the following conditions:

a. The production of the whole product portfolio (and related electricity consumption) occurs in a separate site (building), the energy type physical related to this separated site may be used.
b. The production of the product portfolio (and related electricity consumption) occurs in a shared space with specific energy metering or purchase records or electricity bills for the portfolio, the portfolio specific information (measure, record, and bill) may be used.

7.13.5 For multiple locations

In case an OEF covers different manufacturing locations or countries, the electricity mix shall reflect the ratios of production or ratios of sales between EU countries/regions. To determine the ratio a physical unit shall be used (e.g. number of pieces or kg of product). For OEF studies where such data are not available, the average EU residual mix (EU-28 +EFTA), or region representative residual mix, shall be used. The same general guidelines mentioned above shall be applied.

7.13.6 Electricity use at the use stage

For the use stage the consumption grid mix shall be used. The electricity mix shall reflect the ratios of sales between EU countries/regions. To determine the ratio a physical unit shall be used (e.g. number of pieces or kg of product). Where such data are not available, the average EU consumption mix (EU-28 +EFTA), or region representative consumption mix, shall be used.

7.13.7 How to deal with on-site electricity generation?

If on-site electricity production is equal to the site own consumption, two situations apply: the company shall:

- No contractual instruments have been sold to a third party: the applicant shall model its own electricity mix (combined with LCI datasets).
- Contractual instruments have been sold to a third party: the applicant shall use 'country-specific residual grid mix, consumption mix' (combined with LCI datasets).

If electricity is produced in excess of the amount consumed on-site within the defined system boundary and is sold to, for example, the electricity grid, this system can be seen as a multifunctional situation. The system will provide two functions (e.g. product + electricity) and the following rules shall be followed:

- If possible, apply subdivision.
- Subdivision applies both to separate electricity productions or to a common electricity production where you may allocate based on electricity amounts the upstream and direct emissions to your own consumption and to the share you sell out of your company (e.g. if a company has a wind mill on its production site and export 30% of the produced electricity, emissions related to 70% of produced electricity should be accounted in the OEF study.

- If not possible, direct substitution shall be used. The country-specific residual consumption electricity mix shall be used as substitution[54].
- Subdivision is considered as not possible when upstream impacts or direct emissions are closely related to the product itself.

7.13.8 Electricity modelling for benchmark calculations

In benchmark calculations the following electricity mix shall be used in hierarchical order:

(i) Sector specific information on the use of green electricity shall be used if:
   a. available, and
   b. the set of minimum criteria to ensure the contractual instruments are reliable is met. This can be combined with the remaining electricity to be modelled with the residual grid mix.

(ii) In case no sector specific information is available, the consumption grid mix shall be used.

In case the benchmark is produced in different locations or sold in different countries, the electricity mix shall reflect the ratios of production or ratios of sales between EU countries/regions. To determine the ratio a physical unit shall be used (e.g. number of pieces or kg of product). Where such data are not available, the average EU consumption mix (EU-28 +EFTA), or region representative consumption mix, shall be used.

7.14 Modelling transport

The OEFSR shall provide default transport scenarios to be used in case these data are not listed as mandatory company-specific information and supply-chain specific information is not available. The default transport scenarios shall reflect the European average transport, including all different transport options within the current product category (e.g., home delivery). Future transport options (not existing yet today at real scale) shall be excluded. In case no OEFSR-specific data is available the default scenarios and values outlined below shall be used.

Replacement of the default values below with OEFSR-specific values shall be clearly mentioned and justified in the OEFSR.

The (final and intermediate) client of the product shall be defined in the OEFSR[55]. The final client may be a consumer (i.e. a person who purchases goods and services for personal use) or a company that uses the product for final use, such as restaurants, professional painters, or a construction site. Re-sellers and importers are intermediate clients and not final clients.

[54] For some countries, this option is a best case rather than a worst case.

[55] A clear definition of the final client facilitates a correct interpretation of the OEFSR by practitioners which will enhance the comparability of results.

7.14.1 How to allocate the transport burdens

7.14.1.1 Truck transport

LCA datasets for truck transport are per tkm (tonne*km) expressing the environmental impact for 1 tonne of product that drives 1km in a truck with certain load. The transport payload (=maximum mass allowed) is indicated in the dataset. For example, a truck of 28-32t has a payload of 22t. The LCA dataset for 1tkm (fully loaded) expresses the environmental impact for 1 ton of product that drives 1km within a 22t loaded truck. The transport emissions are allocated based on the mass of the product transported and you get only 1/22 share of the full emissions of the truck. When the mass of a full freight is lower than the load capacity of the truck (e.g., 10t), the transport of the product may be considered volume limited. In this case, the truck has less fuel consumption per total load transported and the environmental impact per ton of product is 1/10 share of the total emissions of the volume limited truck. Within the EF-compliant transport datasets available at http://lcdn.thinkstep.com/Node/, the transport payload is modelled in a parameterised way through the utilisation ratio. The utilisation ratio is calculated as the kg real load divided by the kg payload and shall be adjusted upon the use of the dataset. In case the real load is 0 kg, a real load of 1 kg shall be used to allow the calculation. Note that default truck volumes cannot be provided as this strongly depends on the type of material transported. In case truck volumes are needed to calculate the volume limited transport load, OEFSR-specific data should be used.

The OEFSR shall specify the utilisation ratio to be used for each truck transport modelled, as well clearly indicate whether the utilisation ratio includes empty return trips.

- If the load is mass limited: a default utilisation ratio of 64%[56] shall be used. This utilisation ratio includes empty return trips. Therefore, empty returns shall not be modelled separately. The OEFSR shall list the truck dataset as indicated on the node, together with the utilisation factor to be used (64%). The OEFSR shall clearly indicate that the user shall check and adapt the utilisation factor.
- If the load is volume limited and the full volume is used: the OEFSR shall indicate the product-specific utilisation ratio calculated as the kg real load/kg payload of the dataset and indicate how empty returns shall be modelled.
- If the load is delicate (e.g. flowers): the full truck volume might not be used. The OEFSR shall evaluate the most appropriate load factor to be applied.
- Bulk transport (e.g., gravel transport from mining pit to concrete plant) shall be modelled with a default utilisation ratio of 50% (100% loaded outbound and 0% loaded inbound).
- Reusable products and packaging shall be modelled with OEFSR-specific utilisation ratios. The default value of 64% (including empty return) cannot be used because the return transport is modelled separately for reusable products.

[56] Eurostat 2015 indicates that 21% of the kms truck transport are driven with empty load and 79% are driven loaded (with an unknown load). In Germany only, the average truck load is 64%.

7.14.1.2 Van transport

Vans are often used for home delivery products like books and clothes or home delivery from retailers. For vans the mass is never a limiting factor, but rather the volume, where often the van is half empty. Therefore, a default utilisation ratio of 50% shall be used[57]. A lorry of <7.5t shall be used as approximation, with an utilisation ratio of 20%. A lorry of <7.5t with a payload of 3.3t and an utilisation ratio of 20%, comes to the same load as a van with payload of 1.2t and utilisation ratio of 50%.

7.14.1.3 Consumer transport

LCA datasets for consumer transport (typically, passenger car) are per km. In the OEF context the allocation of the car impact shall be based on volume. The maximum volume to be considered for consumer transport is 0.2 m^3 (around 1/3 of a trunk of 0.6 m^3). For products larger than 0.2 m^3 the full car transport impact shall be considered. For products sold through supermarkets or shopping malls, the product volume (including packaging and empty spaces such as between fruits or bottles) shall be used to allocate the transport burdens over the product transported. The allocation factor shall be calculated as the volume of the product transported divided by 0.2 m^3. For simplification, all other types of consumer transport (like buying in specialised shops or using combined trips) shall be modelled as through supermarket. The OEFSR shall prescribe the default allocation value to be used.

7.14.2 From supplier to factory

The OEFSR shall specify default transport distance to be used for the transport of product from supplier to factory. If specific data are not included in the OEFSR, then the default data provided below shall be used.

<u>For suppliers located within Europe:</u>

For packaging materials from manufacturing plants to filler plants (beside glass; values based on Eurostat 2015[58]), the following scenario shall be used:

- 230 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), OEFSR specific utilisation ratio; and
- 280 km by train (average freight train; UUID 02e87631-6d70-48ce-affd-1975dc36f5be); and
- 360 km by ship (barge; UUID 4cfacea0-cce4-4b4d-bd2b-223c8d4c90ae).

For transport of empty bottles (communication from FEVE[59]), the following scenario shall be used:

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[57] as no EF-compliant dataset for van transport (with payload of ± 1.2t) is currently available at http://lcdn.thinkstep.com/Node/).

[58]Calculated as the mass weighted average of the goods categories 06, 08 and 10 using the Ramon goods classification for transport statistics after 2007. The category 'non metallic mineral products' are excluded as they can double count with glass.

[59] Based on the peer reviewed LCA study of the European container glass, FEVE 2016. Primary data collected among 84% of the European container glass manufactures.

- 350 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), OEFSR specific utilisation ratio; and
- 39 km by train (average freight train; UUID 02e87631-6d70-48ce-affd-1975dc36f5be); and
- 87 km by ship (barge; UUID 4cfacea0-cce4-4b4d-bd2b-223c8d4c90ae).

For all other products from supplier to factory (values based on Eurostat 2015[60]), the following scenario shall be used:

- 130 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), OEFSR specific utilisation ratio; and
- 240 km by train (average freight train; UUID 02e87631-6d70-48ce-affd-1975dc36f5be); and
- 270 km by ship (barge; UUID 4cfacea0-cce4-4b4d-bd2b-223c8d4c90ae).

For all suppliers located outside Europe, the following scenario shall be used:

- 1000 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), for the sum of distances from harbour/airport to factory outside and inside Europe. OEFSR specific utilisation ratio; and
- 18000 km by ship (transoceanic container; UUID 6ca61112-1d5b-473c-abfa-4accc66a8a63) or 10'000 km by plane (cargo; UUID 1cc5d465-a12a-43da-aa86-a9c6383c78ac).
- If producers country (origin) is known: the adequate distance for ship and airplane should be determined using http://www.searates.com/services/routes-explorer or https://co2.myclimate.org/en/flight_calculators/new

In case it is unknown if the supplier is located within or outside Europe, the transport shall be modelled as supplier being located outside Europe.

7.14.3 From factory to final client

The transport from factory to final client (including consumer transport) should be included in the distribution stage of the OEFSR. To decide whether to include transport form factory to final client, the TS shall evaluate if it helps fair comparisons between organisations (e.g. organisations that have in their product portfolio products delivered through traditional shops as well as delivered at home) and if the transport scenario to final client is under the control of the organisation.

When transport from factory to final client is included, in case no OEFSR-specific transport scenario is available, the default scenario outlined below shall be used as a basis (see Figure 5) together with a number of OEFSR-specific values:

- Ratio between products sold through retail, distribution centre (DC) and directly to the final client;

[60] Calculated as the mass weighted average of the goods of all categories.

- For factory to final client: Ratio between local, intracontinental and international supply chains;
- For factory to retail: distribution between intracontinental and international supply chains.

The OEFSR-specific values may be replaced by supply-chain-specific information following the Data Needs Matrix (DNM).

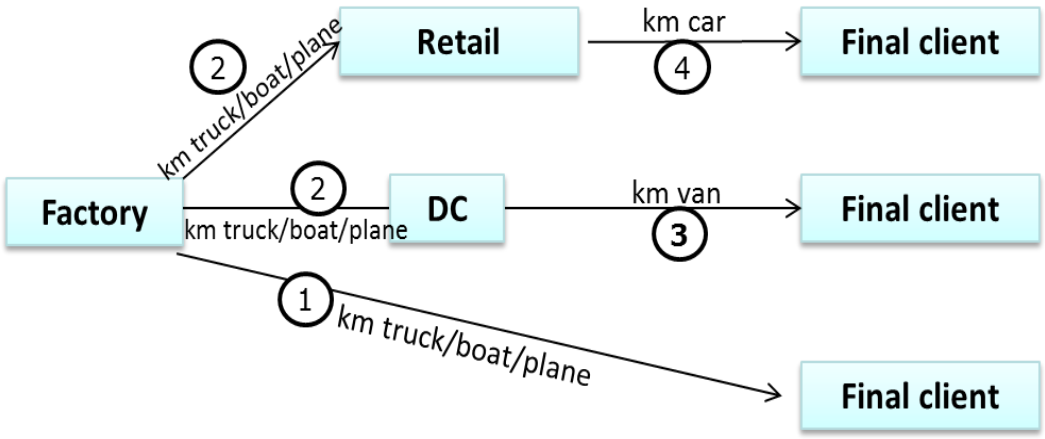

Figure 5. Default transport scenario from factory to client

(1) X% (OEFSR specific) from factory to final client:

- X% (OEFSR specific) local supply chain: 1'200 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), OEFSR specific utilisation ratio.
- X% (OEFSR specific) intracontinental supply chain: 3'500 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), OEFSR specific utilisation ratio.
- X% (OEFSR specific) international supply chain: 1'000 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), OEFSR specific utilisation ratio and 18'000 km by ship (transoceanic container; UUID 6ca61112-1d5b-473c-abfa-4accc66a8a63). Note that for specific cases, plane or train may be used instead of ship.

(2) X% (OEFSR specific) from factory to retail/DC:

- X% (OEFSR specific) local supply chain: 1'200 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), OEFSR specific utilisation ratio.
- X% (OEFSR specific) intracontinental supply chain: 3'500 km by (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), OEFSR specific utilisation ratio.
- X% (OEFSR specific) international supply chain: 1'000 km truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), OEFSR specific utilisation ratio and 18’000 km by ship (transoceanic container; UUID 6ca61112-1d5b-473c-abfa-4accc66a8a63). Note that for specific cases, plane or train may be used instead of ship.

(3) X% (OEFSR specific) from DC to final client:

- 100% Local: 250 km round trip, by van (lorry <7.5t, EURO 3, utilisation ratio of 20%; UUID aea613ae-573b-443a-aba2-6a69900ca2ff)

(4) X% (OEFSR specific) from retail to final client:

- 62%: 5 km, by passenger car (average; UUID 1ead35dd-fc71-4b0c-9410-7e39da95c7dc), OEFSR specific allocation
- 5%: 5 km round trip, by van (lorry <7.5t, EURO 3 with utilisation ratio of 20%[6]; UUID aea613ae-573b-443a-aba2-6a69900ca2ff)
- 33%: no impact modelled

Note that for reusable products the return transport from retail/DC to factory shall be modelled in addition to the transport needed to go to retail/DC. The same transport distances as from product factory to final client shall be used (see above), however the truck utilisation ratio might be volume limited depending on the type of product. The OEFSR shall indicate the utilisation ratio to be used for the return transport.

7.14.4 From EOL collection to EOL treatment

The transport from collection place to EOL treatment is included in the landfill, incineration and recycling datasets tendered by the EC. However, there are some cases, where additional default data might be needed by the OEFSR. The following values shall be used in case no better data is available:

- Consumer transport from home to sorting place: 1 km by passenger car (UUID 1ead35dd-fc71-4b0c-9410-7e39da95c7dc)[61]
- Transport from collection place to methanization: 100 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57)
- Transport from collection place to composting: 30 km by truck (lorry <7.5t, EURO 3 with UUID aea613ae-573b-443a-aba2-6a69900ca2ff)

7.14.5 Transport processes for cooled and frozen product

Note that the transport processes from factory to final client, DC and retail suggested above are for products at ambient temperature only. Products frozen or cooled are to be transported in freezers or coolers. These datasets are available at http://lcdn.thinkstep.com/Node/.

[61] Assumption (Justification: 75% of households do not need to "move" their waste, or can simply do it by walking. However 25% of the households do about 4 km by car to bring their waste to a local collection place (whether for trash or for recycling), which corresponds in average for all waste to 1 km by car).

7.15 Modelling infrastructure and equipment

For screening studies all processes shall be included in the modelling without applying any cut-off. For this, the following default modelling approaches shall be used in case no better data is available. Note that the below data and values are based on assumptions (except indicated otherwise). For all other infrastructures and equipment not included below, the modelling assumptions and secondary datasets used shall be clearly documented.

7.15.1 Distribution centre (DC)

- Infrastructure and building: a distribution centre is a 30000 m^2 building, 5 m high, and with a 30000 m^2 parking. Fridges and freezers equipment (production and end-of-life) shall be considered for DCs that contains cooling systems. Default data for fridge or freezer production of 1m^3 external volume and an internal storage space of 210 L (15 years lifetime): 20 kg iron, 1.5 kg aluminium, 7.8 kg compressor, 0.01 kg copper, 0.06 kg cables, 0.3 kg glass, 6 kg plastic, 1 kg oil, 4 kg insulating foam, 1.1 kg water, 0.04 kg pollutant (using mercury as proxy) (Swiss Energy, October 2012). Packaging: 4 kg cardboard, 0.5 kg plastic film (LDPE), along with a 50 g paper notice.
- Energy consumption: the storage energy consumption is 30 kWh/m^2·year and 360 MJ bought (= burnt in boiler) or 10 Nm^3 natural gas/m^2·year (if using the value per Nm^3, do not forget to consider emissions from combustion and not only production of natural gas). For DCs that contain cooling systems an additional energy use for the chilled or frozen storage is 40 kWh/m^3·year (with an assumption of 2 m high for the fridges and freezers). For DCs with both ambient and cooled storage: 20% of the area of the DC is chilled or frozen. Note: the energy for chilled or frozen storage is only the energy to "keep cool".
- Refrigerant gases consumption and leakages for DCs that contains cooling systems: gas content in fridges and freezers is 0.29 kg R404A per m^2 (retail OEFSR). A 10% annual leakage is considered (Palandre 2003). For the portion of refrigerant gases remaining in the equipment at end-of-life, 5% is emitted at end-of-life and the remaining fraction is treated as hazardous waste.
- Water: 365 m^3 of water is used per year for activities such as cleaning, lawn irrigation, etc. The production of this amount of tap water as well as its treatment in wastewater treatment plant shall be considered.
- Allocation of the DC space-time per product: The distribution centre impact per product is calculated using an allocation based on the total storage capacity of the distribution centre. An average distribution centre can store 60000 m^3 of product, being 48'000 m^3 for ambient storage and 12000 m^3 for chilled or frozen storage (assuming 50% of the 30000 m^2 building is dedicated to storage on 4 m high). Storage during 52 weeks, i.e., 3120000 m^3-weeks/year. The total storage capacity shall be allocated with the following storage volumes and times:
    - For ambient products: 4 times the product volume * stored 4 weeks
    - For chilled products: 3 times the product volume * stored 1 week
    - For frozen products: 2 times the product volume * stored 4 weeks

7.15.2 Retail space

In case there is no specialization of retail, the default data presented below shall be used in the modelling.

- Infrastructure: A retail centre shall be modelled as a 2000 m^2 building with 4000 m^2 parking (the value for parking includes both employees and clients parking as well as all infrastructures such as the access road, area for delivery, etc.)
- Fridges and freezers in case of cooling: 60 m^2 fridges and 60 m^2 freezer, 2 m high, i.e., 240 m^3 fridges measured as external volume with 50% being "internal storage volume" (= 120 m^3). Default data for fridge or freezer production of 1m^3 external volume and an internal storage space of 210 L (15 years lifetime): 20 kg iron, 1.5 kg aluminium, 7.8 kg compressor, 0.01 kg copper, 0.06 kg cables, 0.3 kg glass, 6 kg plastic, 1 kg oil, 4 kg insulating foam, 1.1 kg water, 0.04 kg pollutant (using mercury as proxy) (Swiss Energy, October 2012). Packaging: 4 kg cardboard, 0.5 kg plastic film, along with a 50 g paper notice.
- Energy consumption[62]: A general energy consumption of 300 kWh/m^2·year for the entire building surface. For retail specialized in non-food/non-beverage products: 150 kWh/m^2·year for the entire building surface. For retail specialized in food/beverage products: 400 kWh/m^2·year for the entire building surface plus energy consumption for chilled and frozen storage of 1900 kWh/m^2·year and 2700 kWh/m^2·year respectively.
- Refrigerant gases: Gas content in fridges and freezers is 0.29 kg R404A per m^2. The production and end-of-life, as well as the leakages shall be considered and 10% annual leakage (Palandre 2003). For the portion of refrigerant gases remaining in the equipment at end-of-life, 5% are assumed to be emitted at end-of-life and the remaining fraction is treated as hazardous waste.
- Water: 3'650 m^3 of water is used per year for activities such as cleaning, customer bathrooms, lawn irrigation, etc. The production of this amount of tap water as well as its treatment in wastewater treatment plant shall be considered.
- Allocation of the retail space-time per product: A retail place can store 2'000 m^3 of products (assuming 50% of the 2'000 m^2 building is covered by shelves of 2 m high) during 52 weeks, i.e., 104000 m^3-weeks/year. The total storage capacity shall be allocated with the following storage volumes and times:
    - For ambient products: 4 times the product volume * stored 4 weeks
    - For chilled products: 3 times the product volume * stored 2 weeks
    - For frozen products: 2 times the product volume * stored 4 weeks
- Repacking: consuming about 3 t plastic film (LDPE) per supermarket per year. The production and end-of-life (100% recycling) of LDPE packaging film shall be considered. This represent a default value of 0.47 g LDPE film / kg of product[63].

[62]Derived from table 17, p. 59, of the PERIFEM and ADEME "Guide sectorial 2014: Réalisation d'un bilan des emissions de gaz à effet de serre pour distribution et commerce de detail".

[63]The virtual retailer considered for the OEF retail screening sells about 6370 tons products per supermarket per year.

7.15.3 Fridge

- Fridge size: assumed to 1 m^3 (external volume, measured as a rectangular cuboid including space lost due to protuberances, for example to calculate its space use in a DC or in a truck during delivery) and with an internal storage space of 210 L.
- Material composition: 20 kg iron, 1.5 kg aluminium, 7.8 kg compressor, 0.01 kg copper, 0.06 kg cables, 0.3 kg glass, 6 kg plastic, 1 kg oil, 4 kg insulating foam, 1.1 kg water, 0.04 kg pollutant (using mercury as proxy) (Swiss Energy, October 2012). Packaging is assumed to be made of 4 kg cardboard, 0.5 kg plastic film, along with a 50 g paper notice.
- Fridge maintenance: assumed to be 12 washings per year (with 1 L water and 1 g soap for each washing).
- Refrigerant gas: about 100 g R134a/fridge and 1% leakage (IPCC/TEAP 2005) (note that when the fridge is used as a proxy for cooling infrastructure in DCs and retailer, the refrigerant gas production and leakage should be removed to avoid double counting with the values used directly in the modelling of DCs and retailer).

7.15.4 Dishwasher

- Material composition: 10 kg plastic, 20 kg steel, 15 kg aluminium, 3 kg electronic components, 0.1 kg printed wiring board. Packaging is assumed to be 10 kg cardboard and 2 kg plastic.
- A fraction of a cycle is allocated depending on the dish size (assumptions):
    - 20% for a pot, a baking dish or a frying pan
    - 14.3% for a medium pan
    - 10% for a small pan or a vase
    - 5% for a drip filter decanter, a pet food dish or an ashtray
    - 3.3% for a bowl
    - 2.5% for a glass, a mug, a tea cup or a normal plate
    - 1.67% for a small plate or an espresso cup
    - 0.5% for each cutlery piece

7.15.5 Small equipment to be considered

- Frying pan: 1 kg steel and 200 g plastic. Lifetime: 500 uses
- Cooking pot: 1 kg steel and 100 g plastic. Lifetime: 1500 uses
- Glass: 260 g glass. Lifetime: 365 uses
- Baking sheet: 200 g steel. Lifetime: 780 uses
- Cup: 260 g ceramic. Lifetime: 365 uses
- Pet food dish: 200 g plastic. Lifetime: 3650 uses

- Polypropylene plastic bag for general trash: 6.7g PP per kg of waste (35 g plastic for a 35 L bag, own measurement; average municipal solid waste density is 150 kg/m^3) [64]
- Polypropylene plastic bag for recycled green waste and food waste: 2.5g PP per kg of waste (35 g plastic for a 35 L bag, own measurement). The average green/food waste density is 400 kg/m^3) [65]

7.16 Packaging modelling

7.16.1 Packaging datasets

A large number of EF-compliant packaging related datasets are available on the node (http://lcdn.thinkstep.com/Node). These European average packaging datasets shall be used in case the OEFSR doesn't request the use of primary data, no supplier-specific information is available or the packaging is not relevant. Although the default secondary datasets shall be listed in the OEFSR to be used by the applicants, for some multi-material packaging the OEFSR should or shall provide additional information to allow the applicant to perform a correct modelling. This is the case for beverage cartons and bag-in-box packaging.

Beverage cartons are made out of LDPE granulates and liquid packaging board, with or without aluminium foil. The amount of LDPE granulates, board and foil (also called the bill of material of beverage cartons) depends on the application of the beverage carton (e.g., wine cartons, milk cartons) and shall be defined in the OEFSR. Beverage cartons shall be modelled by combining the prescribed amounts of material datasets with the beverage carton conversion dataset. The OEFSR shall refer to the respective PEFCR(s) if available

Bag in box is made out of corrugated board and packaging film. The OEFSR should define the amount of corrugated board, as well as the amount and type of packaging film. If this is not prescribed by the OEFSR or the OEFSR doesn't refer to the respective PEFCR(s) if available, the applicant applying the OEFSR shall use the default dataset for bag-in-box.

[64] http://www.senat.fr/rap/o98-415/o98-4151.html, http://www.ic.gc.ca/eic/site/csr-rse.nsf/eng/rs00181.html, http://www.ijastnet.com/journals/Vol._1_No._3;_June_2011/8.pdf, http://www.academia.edu/3013719/Comprehensive_Characteristics_of_the_Municipal_Solid_Waste_Generated_in_the_Faculty_of_Engineering_UKM, http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/RO/Latin_A/Topic_g.asp

[65] http://www.epa.vic.gov.au/business-and-industry/lower-your-impact/~/media/Files/bus/EREP/docs/wastematerials-densities-data.pdf

7.16.2 Packaging reuse rates

Reuse rate is the number of times a packaging material is used (e.g., filled) at the factory. This is often also called trip rates, reuse time or number of rotations. This may be expressed as the absolute number of reuse or as % of reuse rate. For example: a reuse rate of 80% equals 5 reuses. Equation 14 describes the conversion:

$$\text{Number of reuse} = \frac{1}{100\% - \%\ reuse\ rate} \qquad \text{[Equation 14]}$$

The number of reuse applied here refers to the total number of uses during the life of a packaging. It includes both the first use and all the following reuses.

A packaging return system can be organized by the company owning the packaging material (company owned pools) or can be organized at a higher level by a third party e.g., the government or a pooler (third party operated pools). This may have an influence on the lifetime of the material as well as the data source to be used. Therefore, it is important to separate these two return systems.

For company owned packaging pools the reuse rate shall be calculated using supply-chain-specific data. Depending on the data available within the company, two different calculation approaches may be used (see Option a and b presented below). Returnable glass bottles are used as example but the calculations also apply for other company owned reusable packaging.

Option a: The use of supply-chain-specific data, based on accumulated experience over the lifetime of the previous glass bottle pool. This is the most accurate way to calculate the reuse rate of bottles for the previous bottle pool and can be a proper estimate for the current bottle pool. The following supply-chain-specific data is collected (see wiki page 'Access to documents of common interest 'https://webgate.ec.europa.eu/fpfis/wikis/display/ EUENVFP/):

- Number of bottles filled during the lifetime of the bottle pool (#Fi)
- Number of bottles at initial stock plus purchased over the lifetime of the bottle pool (#B)

$$\text{Reuse rate of the bottle pool} = \frac{\#\ F_i}{\#B} \qquad \text{[Equation 15]}$$

$$\text{The net glass use (kg glass/l beverage)} = \frac{\#B \times (kg\ glass/bottle)}{\#F_i} \qquad \text{[Equation 16]}$$

This calculation option shall be used:

i. With data of the previous bottle pool when the previous and current bottle pool are comparable. Meaning, the same product category, similar bottle characteristics (e.g., size), comparable return systems (e.g., way of collection, same consumer group and outlet channels), etc.
ii. With data of the current bottle pool when future estimations/extrapolations are available on (i) the bottle purchases, (ii) the volumes sold, and (iii) the lifetime of the bottle pool.

The data shall be supply-chain-specific and shall be verified by an external verification, including the reasoning of this method choice.

Option b: When no real data is tracked the calculation shall be done partly based on assumptions. This option is less accurate due to the assumptions made and therefore conservative/safe estimates shall be used. The following data is needed:

- Average number of rotations of a single bottle, during one calendar year (if not broken). One loop consists of filling, delivery, use, back to brewer for washing (#Rot)
- Estimated lifetime of the bottle pool (LT, in years)
- Average percentage of loss per rotation. This refers to the sum of losses at consumer and the bottles scrapped at filling sites (%Los)

$$\text{Reuse rate of the bottle pool} = \frac{LT}{(LT \times \%Los) + \left(\frac{1}{\#Rot}\right)} \quad \text{[Equation 17]}$$

This calculation option shall be used when option a is not applicable (e.g., the previous pool is not usable as reference). The data used shall be verified by an external verification, including the reasoning of this method choice.

7.16.3 Average reuse rates for company owned pools

The following average reuse rates shall be used within the screening studies and to calculate the benchmark (corresponding to the representative product) for those OEFSRs that have company owned reusable packaging pools in scope, unless data of better quality is available:

- Glass bottles: 20 trips for beer and water bottles[66], 2 trips for wine[67]
- Plastic crates for bottles: 30 trips[68]
- Plastic pallets: 30 trips (Nederlands Instituut voor Bouwbiologie en Ecologie, 2014[69])

If the TS decide to use other values within their OEF screening study or benchmark calculation, they shall clearly justify why and provide the data source. In case a specific packaging type is not present in the list above, sector-specific data shall be used. New values shall be subject to the OEFSR review.

[66] Agreement from packaging working group members (including beer and packed water pilot).

[67] Estimation: http://ec.europa.eu/environment/waste/studies/packaging/belgium.pdf

[68] Technical approximation as no data source could be found. Technical specifications guarantee a lifetime of 10 years. A return of 3 times per year (between 2 to 4) is taken as first approximation.

[69] Most conservative number is used.

7.16.4 Average reuse rates for third party operated pools

Average reuse rates provided by literature vary a lot, are not usable as such or too country specific. Some data sources are outdated (more than 15 years old) and thus not representative for the current situation (http://ec.europa.eu/environment/waste/studies/reuse.htm). Some others are biased due to a significant change in consumer behaviour. For example, the return rate of beer bottles in Denmark is higher than 100% due to a decrease of this packaging in sales (Årsrapport, 2013). One recent study is valid for Germany only and provides reuse rates for reusable glass bottles in third party operated pools and company owned pools (Deloitte, 2014).

The following reuse rates shall be used by those OEFSRs that have third party operated reusable packaging pools in scope, unless data of better quality is available:

- Glass bottles: 30 trips for beer and water[70], 5 trips for wine[71]
- Plastic crates for bottles: 30 trips[72]
- Plastic pallets: 50 trips (Nederlands Instituut voor Bouwbiologie en Ecologie, 2014)[73]
- Wooden pallets: 25 trips (Nederlands Instituut voor Bouwbiologie en Ecologie, 2014)[74]

If the TS decides to use other values within their final OEFSR, they shall clearly justify why and provide the data source. In case a specific packaging type is not present in the list above, sector-specific data shall be collected and included in the OEFSR. New values shall be subject to the OEFSR review.

[70]The reuse rates for third party operated glass bottle pools was largely discussed within the packaging working group. Literature provides values between 5 and 50 reuse rates, but is mainly outdated. The study of Deloitte (2014) is most recent but provides values within the German context only. It can be questioned if these results are directly applicable for the European context. However, the study provides results for both company owned pools (23 trips, considering all foreign bottles as exchanged) and third party operated pools (36 trips, considering all foreign bottles as exchanged). It shows that the reuse rates for third party operated pools are ±1.5 times higher than for company owned pools. As first approximation the packaging working group proposes to use this ratio to extrapolate the average reuse rates for company owned pools (20 trips) towards average reuse rates for third party operated pools (20*1.5= 30 trips).

[71]Assumption based on monopoly system of Finland. http://ec.europa.eu/environment/waste/studies/packaging/finland.pdf

[72] Technical approximation as no data source could be found. Technical specifications guarantee a lifetime of 10 years. A return of 3 times per year (between 2 to 4) is taken as first approximation.

[73] The less conservative number is used.

[74] Half of plastic pallets is used as approximation.

7.17 Use stage modelling

The use stage is a life cycle stage that can result in a high overall environmental contribution for many OEFSRs. As the use stage is calculated based on many modelling assumptions, the real contribution is affected by potentially very high uncertainties.

For the OEF screening study and supporting studies the use stage shall always be included for final products by following the guidelines outlined below. The use stage shall be excluded for intermediate products.

7.17.1 Definition of the use stage

The use stage describes how the product is expected to be used by the end user (e.g., the consumer). The use stage starts at the moment the end user uses the product, till (and excluded) it leaves its place of use and enters the end-of-life life cycle stage (e.g., recycling or final treatment), including the necessary transports.

The use stage includes all activities and products that are needed for a proper use of the product (i.e. the provision of the original function is kept throughout its lifetime; see Figure 6). For example, the provision of tap water and wastewater treatments when cooking pasta; the manufacturing, distribution and waste management of paper filters for coffee; manufacturing, distribution and waste of materials needed for maintenance, repair or refurbishment (e.g. spare parts needed to repair the product, the coolant production and waste management due to losses). The following additional requirements shall be followed:

(i) The waste of the product in use (e.g., food waste, primary packaging, or the product left at its end of use) is excluded and shall be part of the End of Life stage of the product.

(ii) If a product is reused, the processes needed to collect the product and make it ready for the new use cycle are excluded (e.g. the impacts from collection and cleaning reusable bottles).

(iii) Transport from retail to consumer home shall be excluded from the use stage and may be included in the distribution stage.

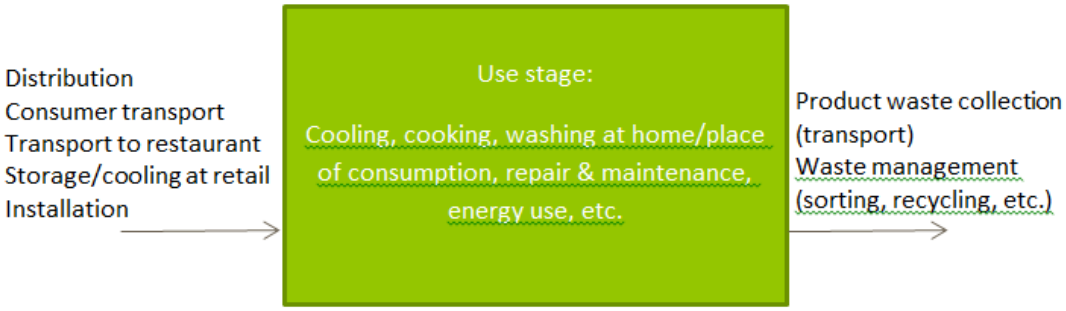

Figure 6. Processes included and excluded from the use stage

The use stage often involves multiple processes. A distinction shall be made between (i) product independent and (ii) product dependent processes.

(i) ***Product independent processes*** have no relationship with the way the product is designed or distributed. The use stage process impacts will remain the same for all products in this product (sub) category even if the producer changes the product's characteristics. Therefore, they don't contribute to any form of differentiation between two products or might even hide the difference. Examples are the use of a glass for drinking wine (considering that the product doesn't determine a difference in glass use); frying time when using olive oil; energy use for boiling one litre of water to be used for preparing coffee made from bulk instant coffee; the washing machine used for heavy laundry detergents (capital good).

(ii) ***Product dependent processes*** are directly or indirectly determined or influenced by the product design or are related to instructions for use of the product. These processes depend on the product characteristics and therefore shall contribute to differentiation between two products. All instructions provided by the producer and directed towards the consumer (through labels, websites or other media) shall be considered as product dependent. Examples of instruction are indications on how long the food must be cooked, how much water must be used, or in the case of drinks the recommended serving temperature and storage conditions. An example of a direct dependent process is the energy use of electric equipment when used in normal conditions.

7.17.2 Main function approach or Delta approach

Modelling of the use stage may be done in different ways. Very often the related impacts and activities are modelled fully. For example, the total electricity consumption when using a coffee machine, or the total cooking time and related gas consumption when boiling pasta. In these cases, the use stage processes for drinking coffee or eating pasta are related to the main function of the product (referred to as "main function approach").

In some cases, the use of one product can influence the environmental impact of another product. Some examples:

i. A toner cartridge is not held responsible for the paper it prints. But if remanufactured toner cartridge works less efficient and causes more paper loss compared to an original cartridge, the additional paper loss should be considered. In that case, the paper loss is a dependent process of the use stage of a remanufactured cartridge. The use stage involves processes and activities which are not 100% related to the product.
ii. The energy consumption during the use stage of the battery/charger system is not related to the amount of energy stored and released from the battery. It only refers to the energy loss in each loading cycle. That energy loss can be caused by the loading system or the internal losses in the battery.

In these cases, only the additional activities and processes should be allocated to the product (e.g. paper and energy of remanufactured toner cartridge and battery). The allocation method consists in taking all associated products in the system (here paper and energy), and allocating the excess consumption of these associated products to the product which is considered responsible for this excess. This requires a reference consumption to be defined for each associated product in the

OEFSR (e.g., of energy and materials). The reference consumption refers to the minimum consumption that is essential for providing the function. The consumption above this reference (the delta) will then be allocated to the product. This approach is also named "Delta approach" by ADEME[75].

In case the Delta approach is used, the OEFSR shall state the minimum consumption (reference) to be used when calculating the additional consumption allocated to the product. This approach should only be used for increasing impacts and to account for additional consumptions above the reference. To define the reference situation, the following shall be considered when existing:

- Regulations applicable to the product category
- Standards or harmonised standards
- Recommendations from manufacturers or manufacturers' organisations
- Use agreements established by consensus in sector-specific working groups.

It is up to the TS to decide which approach is taken and shall describe in the OEFSR which approach shall be applied (main function approach or Delta approach).

7.17.3 Modelling the use stage

For all processes belonging to the use stage (both most relevant and the others):

i. The OEFSR shall indicate which use stage processes are *product dependent and product independent* (as described above).
ii. The OEFSR shall identify for which processes default data shall be provided by following the modelling guidelines in Table 26. In case modelling is optional the TS shall decide whether this is included in the system boundary of the OEFSR calculation model.
iii. Per process to be modelled the TS shall decide and describe in the OEFSR whether the main function approach or Delta approach shall be applied.
    a. Main function approach: The default datasets presented in the OEFSR shall reflect as much as possible the reality of market situations.
    b. In case of the Delta approach, the OEFSR shall provide the reference consumption to be used.
iv. The OEFSR shall follow the modelling and reporting guidelines in Table 26.

Table 26. OEFSR guidelines for the use stage

Is the use stage process…		Actions to be taken by the TS	
Product dependent?	**Most relevant?**	**Modelling guidelines**	**Where to report**

[75] Specifications for drafting and revising product category rules (10.12.2014), ADEME.

Yes	Yes	To be included in the OEFSR system boundary. Provide default data	Mandatory: OEF report, reported separately*
	No	Optional: May be included in the OEFSR system boundary when the uncertainty can be quantified (provide default data)	Optional: OEF report, reported separately*
No	Yes/No	Excluded from the OEFSR system boundary	Optional: qualitative information

*Use stage results for final products shall be reported separately from other life cycle stages and not as additional environmental/technical information.provides default data to be used by the TS to model use stage activities that might be crosscutting for several pilots. The TS shall always apply the following guidelines in hierarchical order:

1. First, the guidelines on data requirements and procedure to identify the most relevant contributions shall be followed (see section 7.3);
2. Second, the guidelines indicated in Table 26 apply;
3. Last, the default data provided in Annex F shall be used to fill in the data gaps and assure consistency among OEFSRs. Better data may be used but shall be justified in the OEFSR.

7.17.4 Example: pasta

Here we present a simplified example on how the environmental footprint of the use stage can be modelled and reported for the product '1 kg dry pasta'.

Table 27 presents the processes used for modelling the use stage of 1kg dry pasta (boiling time according to instructions, for instance: 10 minutes; amount of water, according to the instructions, for instance 10 litres). Among the 4 processes, electricity and heat use are the most relevant one. Within this example, all 4 processes are product dependent. The amount of water use and cooking time is in general indicated on the packaging. The manufacturer can change the recipe in order to increase or reduce the cooking time, and therefore the energy use. Within the OEFSR default data is provided on all four processes, as indicated in Table 28 (activity data + LCI dataset to be used). Following the reporting guidelines, the EF (as a total of all 4 processes) is reported as separate information.

Table 27. Processes of the use stage of dry pasta (taken from the screening study report, and to be used as example). The most relevant processes are indicated in the green box.

Is the use stage process is …?		Pasta processes	Actions taken by the TS:	
(ii) Product dependent?	**(iii) Most relevant?**		**Modelling**	**Reporting**
Yes	Yes	Electricity and Heat	Modelled as main function approach. Default data provided (total energy use).	In the EF report, reported separately
	No	Tap water Waste water	Modelled as main function approach. Default data provided (total water use).	In the EF report, reported separately
No	Yes/No		Excluded from the EF calculation (impact categories)	Optional: qualitative information

Table 28. Example activity data and secondary datasets to be used

Materials/fuels	**Value**	**Unit**
Tap water, at user/RER U	10	kg
Electricity mix, AC, consumption mix, at consumer, <1kV EU-27 S	0.5	kWh
Heat, from resid. Heating systems from NG, consumption mix, at consumer, temperature of 55C EU-27 S	2.3	kWh
Waste to treatment	Value	Unit
Waste water treatment, domestic waste water according to the Directive 91/271/EEC concerning urban waste water treatment plant EU-27 S	10	kg

7.17.5 Example: energy using products

The operating, servicing and maintenance conditions may be product dependant. In that case, they shall be specified by the manufacturer and include the following:

i. The maintenance operation frequency where applicable

ii. The parts, products and solvents used to maintain / service the reference product (e.g., batteries, light sources and any substance covered by a Safety Data Sheet)
iii. The consumables required for operation: ink, etc.

For those processes that are not relevant, their inclusion in the OEFSR calculation model is to be decided by the TS.

7.18 End-of-Life modelling

The waste of products used during the manufacturing, distribution, retail, the use stage or after use shall be included in the overall modelling of the life cycle of the product. Overall, this should be modelled and reported at the life cycle stage where the waste occurs. For example, the EoL of the wastes generated during manufacturing should be modelled and reported at the manufacturing life cycle stage. The end-of-life of the main products in scope is mostly to be modelled in the End-of-Life stage. For waste at use stage, the specific rules to be followed are provided in section 7.17.3. The End-of-Life stage is a life cycle stage that in general includes the waste of the product portfolio in scope, such as the food waste, the products left at its end of use and the primary packaging of the products. For intermediate products, the End-of-Life of the products in scope shall be excluded. Default loss rates per type of product during distribution and at consumer are provided in Annex H and shall be used in case no OEFSR-specific information is available.

The current OEF Guide (Recommendation 2013/179/EU) require the use of a formula to model product waste, commonly known as End-of-Life (EoL) formula, available in the Annex V of the OEF Guide, to deal with multi-functionality in recycling, re-use and energy recovery situations.

The initial feedbacks received by some pilots participating to the EF pilot phase and the further experience gathered during three years of pilot phase, led the Commission to re-consider the EoL formula available in the Annex V and, together with interested stakeholders, to come up with an alternative proposal.

The new formula has been renamed to “Circular Footprint Formula” (CFF) and shall be used in the EF-context instead of the original "End-of-Life" formula. The following sections describe the formula and parameters to be used, while the last sections describe how the formula and parameters shall be applied to final products (see section 7.18.11), to intermediate products (see section 7.18.12) and to construction products (see section 7.18.13).

7.18.1 The Circular Footprint Formula

The CFF is a combination of "material + energy + disposal", i.e.:

Material $(1-R_1)E_V + R_1 \times \left(AE_{recycled} + (1-A)E_V \times \frac{Q_{Sin}}{Q_p}\right) + (1-A)R_2 \times \left(E_{recyclingEoL} - E_V^* \times \frac{Q_{Sout}}{Q_P}\right)$

Energy $(1-B)R_3 \times (E_{ER} - LHV \times X_{ER,heat} \times E_{SE,heat} - LHV \times X_{ER,elec} \times E_{SE,elec})$

Disposal $(1-R_2-R_3) \times E_D$

Equation 18 – *The Circular Footprint Formula (CFF)*

The modular form of the CFF:

The CFF can be arranged in a modular way, to fit for example the structure of the EN 15804 standard.

Equation 19 is the CFF re-arranged in different modules. The acronym for this formula is **CFF-M**.

Production burdens	$(1 - R_1)E_V + R_1 \times E_{recycled}$	**Cradle-to-gate**
Burdens and benefits related to secondary materials input	$-(1 - A)R_1 \times \left(E_{recycled} - E_V \times \frac{Q_{Sin}}{Q_P}\right)$	
Burdens and benefits related to secondary materials output	$(1 - A)R_2 \times \left(E_{recyclingEoL} - E_V^* \times \frac{Q_{Sout}}{Q_P}\right)$	**Additional information from the EoL stage**
Energy recovery	$(1 - B)R_3 \times (E_{ER} - LHV \times X_{ER,heat} \times E_{SE,heat} - LHV \times X_{ER,elec} \times E_{SE,elec})$	
Disposal	$(1 - R_2 - R_3) \times E_D$	

Equation 19 – *Modular form of the Circular Footprint Formula (CFF-M)*[2]

7.18.2 The parameters of the Circular Footprint Formula (*CFF and CFF-M)*

A: allocation factor of burdens and credits between supplier and user of recycled materials.

B: allocation factor of energy recovery processes: it applies both to burdens and credits.

Qs_{in}: quality of the ingoing secondary material, i.e. the quality of the recycled material at the point of substitution.

Qs_{out}: quality of the outgoing secondary material, i.e. the quality of the recyclable material at the point of substitution.

Q_p: quality of the primary material, i.e. quality of the virgin material.

R_1: it is the proportion of material in the input to the production that has been recycled from a previous system.

R_2: it is the proportion of the material in the product that will be recycled (or reused) in a subsequent system. R2 shall therefore take into account the inefficiencies in the collection and recycling (or reuse) processes. R2 shall be measured at the output of the recycling plant.

R_3: it is the proportion of the material in the product that is used for energy recovery at EoL.

$E_{recycled}$ (E_{rec}): specific emissions and resources consumed (per functional unit) arising from the recycling process of the recycled (reused) material, including collection, sorting and transportation process.

$E_{recyclingEoL}$ (E_{recEoL}): specific emissions and resources consumed (per functional unit) arising from the recycling process at EoL, including collection, sorting and transportation process.

E_v: specific emissions and resources consumed (per functional unit) arising from the acquisition and pre-processing of virgin material.

E^*_v: specific emissions and resources consumed (per functional unit) arising from the acquisition and pre-processing of virgin material assumed to be substituted by recyclable materials.

EER: specific emissions and resources consumed (per functional unit) arising from the energy recovery process (e.g. incineration with energy recovery, landfill with energy recovery, …).

$E_{SE,heat}$ and $E_{SE,elec}$: specific emissions and resources consumed (per functional unit) that would have arisen from the specific substituted energy source, heat and electricity respectively.

ED: specific emissions and resources consumed (per functional unit) arising from disposal of waste material at the EoL of the analysed product, without energy recovery.

$X_{ER,heat}$ and $X_{ER,elec}$: the efficiency of the energy recovery process for both heat and electricity.

LHV: Lower Heating Value of the material in the product that is used for energy recovery.

7.18.3 The A factor

The A factor allocates burdens and credits between two life cycles and it aims to reflect market realities.

In OEF studies the A factor values shall be in the range **$0.2 \leq A \leq 0.8$**, to always capture both aspects of recycling (recycled content and recyclability at end-of-life).

The driver to determine the values of the A factor is the analysis of the market situation. This means:

- **A=0.2.** Low offer of recyclable materials and high demand: the formula focus on recyclability at end-of-life**.**
- **A=0.8.** High offer of recyclable materials and low demand: the formula focus on recycled content.

A=0.5. Equilibrium between offer and demand: the formula focuses both on recyclability at EoL and recycled content. This value applies to all materials for which no A value is available in Annex C.

The list of A values is available in Annex C. This table is cross-cutting and shall be used by all OEFSRs. Proposals to include new or updated values of A will be evaluated by the EC. The list of A values in Annex C will be periodically reviewed and updated by the European Commission.

The list of A values to be used shall be clearly listed in the OEFSR, with a reference to Annex C. The following procedure shall be applied by the TS to select the value of A to be included in the OEFSR:

- Check in Annex C the availability of an application specific A value which fits the OEFSR,
- If an application specific A value is not available, the material specific A value in Annex C shall be used,
- If a material specific A value is not available, the A value shall be set equal to 0.5.

The same procedure shall be applied by the applicant in case a specific A value is missing in the OEFSR.

7.18.4 The B factor

The B factor is used as an allocation factor of energy recovery processes. It applies both to burdens and credits. Credits refer to the amount of heat and electricity sold, not to the total produced, taking into account relevant variations over a 12-months period, e.g. for heat.

In OEF studies the B value shall be equal to 0 as default.

To avoid double-counting between the current and the subsequent system in case of energy recovery, the subsequent system shall model its own energy use as primary energy.

Proposals to include new or updated values of B in Annex C will be evaluated by the European Commission. The list of B values will be periodically reviewed and updated by the European Commission.

7.18.5 The point of substitution

It is necessary to determine the point of substitution to apply the “material” part of the formula. The point of substitution corresponds to the point in the value chain where secondary materials substitute primary materials.

The point of substitution shall be identified in correspondence to the process where input flows are coming from 100% primary sources and 100% secondary sources (level 1 in Figure 7). In some cases the point of substitution may be identified after some mixing of primary and secondary material flows has occurred (level 2 in Figure 7). The identification of the point of substitution shall be made depending on the Situations and Options of the DNM.

- **Point of substitution at level 1**: It shall be applied in Situation 1/Option 1, and in Situation 2/Option 1 of the DNM (See Table 29). This point of substitution corresponds to e.g. metal scrap/glass and cullet/pulp input to the process.
- **Point of substitution at level 2**: It shall be applied in Situation 1/Option2, Situation 2/Option 2, Situation 2/Option 3 and Situation 3 of the DNM (See Table 29). This point of substitution corresponds to e.g. metal ingots, glass, paper.
- The point of substitution at this level may be applied only if the datasets used to model e.g. E_{rec} and E_v take into account the real (average) flows regarding primary and secondary materials: for example, if E_{rec} corresponds to the "production of 1 t of secondary material" (see Figure 7) and it has an average input of 10% from primary raw materials, the amount of primary materials, together with their environmental burdens, shall be included in the E_{rec} dataset.

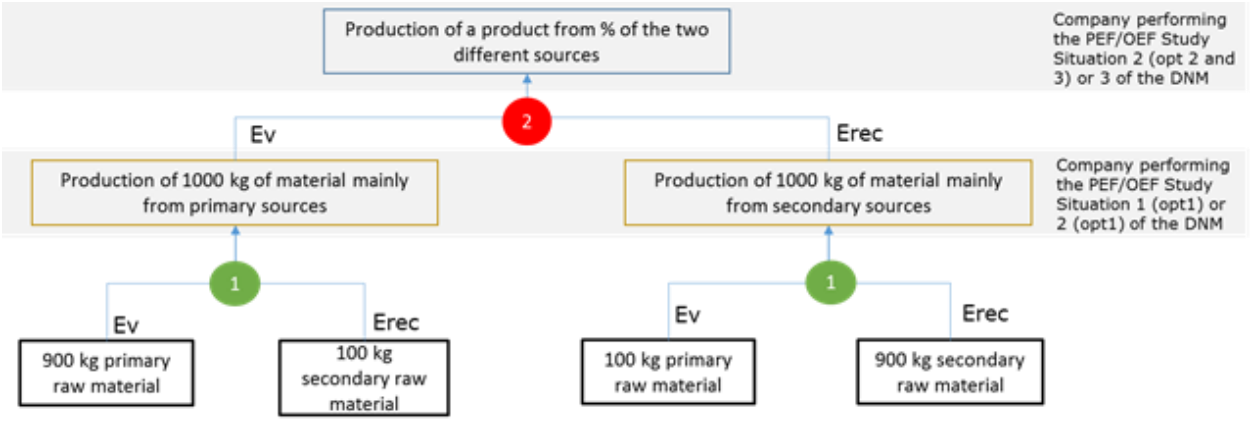

Figure 7. Point of substitution at level 1 and at level 2

Figure 7 is a schematic representation of a generic situation (flows are 100% primary and 100% secondary). In practice in some situations, more than one point of substitution can be identified at different steps in the value chain, as represented in Figure 8, where e.g. scrap of two different qualities is processed at different steps.

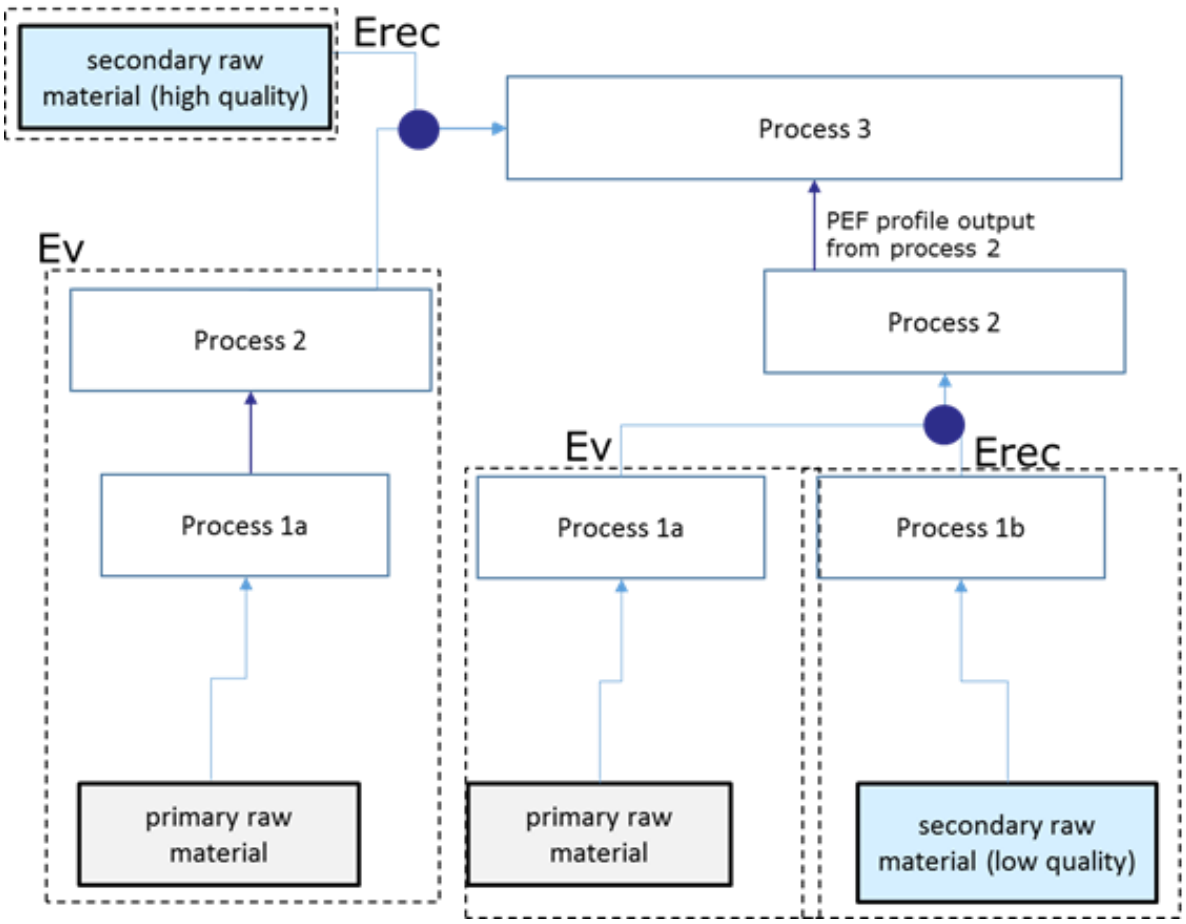

Figure 8. Example of point of substitutions at different steps in the value chain

7.18.6 The quality ratios: Qs_{in}/Qp and Qs_{out}/Qp

Two quality ratios are used in the CFF, to take into account the quality of both the ingoing and the outgoing recycled materials.

Two further cases can be distinguished:

a) If Ev=E*v the two quality ratios are needed: Qs_{in}/Qp associated to the recycled content, and Qs_{out}/Qp associated to recyclability at EoL; the quality factors are there to capture down cycling of a material compared to the original primary material and, in some cases, may capture the effect of multiple recycling loops.

b) If Ev≠E*v one quality ratio is needed: Qs_{in}/Qp associated to the recycled content. In this case E*v refers to the functional unit of the material substituted in a specific application. For example, plastic recycled to produce a bench modelled via substitution of cement, shall take into account also how much, how long, how well. Therefore, the E*v parameter indirectly integrates the Qs_{out}/Qp parameter, and therefore the Qs_{out} and Qp parameters are not part of the CFF.

The quality ratios shall be determined at the point of substitution and per application or material. The quality ratios are OEFSR specific, except for packaging materials (see section 7.18.15.9).

The quantification of the quality ratios shall be based on:

- Economical aspects: i.e. price ratio of secondary compared to primary materials at the point of substitution. In case the price of secondary materials is higher than the primary ones, the quality ratios shall be set equal to 1.
- When economic aspects are less relevant than physical aspects, the latter may be used.

7.18.7 Recycled content (R_1)

The R_1 values applied shall be supply-chain or application specific, in relation with the DNM. The R_1 value shall be set to 0% when no application-specific data is available. Material-specific values based on supply market statistics are not accepted as a proxy.

The applied R_1 values shall be subject to the OEFSR review (if applicable) or OEF study verification (if applicable).

7.18.7.1 Relation with the Data Needs Matrix (DNM)

The choice for 'default R_1 values' or 'company-specific R_1 values' shall be based on the rules of the DNM (see Table 29). This means that company-specific values shall be used when:

- the process is identified in the OEFSR as being most relevant and is run by the company applying the OEFSR,

or:

- the process is listed by the OEFSR as obligatory to be covered by company-specific data.

In all other cases 'default secondary R_1 values' may be used: for example, when R_1 is in situation 2, option 2 of the DNM. In this case company-specific data is not mandatory and default secondary data should be used by the company applying the OEFSR.

Table 29. Requirements regarding R_1 values in relation with the DNM

		Most relevant process	**Other process**
Situation 1: process run by the company applying the OEFSR	**Option 1**	Supply-chain specific R_1 value	
	Option 2		Default (application-specific) R_1 value
Situation 2: process not run by the company applying the OEFSR but with access to (company)-specific information	**Option 1**	Supply-chain specific R_1 value	
	Option 2	Default (application-specific) R_1 value	
	Option 3		Default (application-

			specific) R_1 value
Situation 3: process not run by the company applying the OEFSR and without access to (company)-specific information	**Option 1**	Default (application-specific) R_1 value	
	Option 2		Default (application-specific) R_1 value

7.18.7.2 Guidelines when using supply-chain specific R_1 values

When using supply-chain specific R_1 values other than 0, traceability throughout the supply chain is necessary. The following general guidelines shall be followed when using supply-chain specific R_1 values:

- The supplier information (through e.g., statement of conformity or delivery note) shall be maintained during all stages of production and delivery at the converter;
- Once the material is delivered to the converter for production of the end products, the converter shall handle information through their regular administrative procedures;
- The converter for production of the end products claiming recycled content shall demonstrate through his management system the [%] of recycled input material into the respective end product(s).
- The latter demonstration shall be transferred upon request to the user of the end product. In case an OEF profile is calculated and reported, this shall be stated as additional technical information of the OEF profile.
- Industry- or company-owned traceability systems may be applied as long as they cover the general guidelines outlined above. If not, they shall be supplemented with the general guidelines above.

7.18.7.3 Guidelines when using default R_1 values

Default R_1 values are available in Annex C: these values are application specific. Default R_1 values shall be used if there is an application-specific value available in Annex C. If no application-specific value is available in Annex C, the R_1 value shall be set equal to 0.

The OEFSR shall (i) prescribe the list of R_1 values which shall be used by the applicant in case no company-specific values are available and (ii) shall make a reference to Annex C.

7.18.7.4 Guidelines on how to deal with pre-consumer scrap

When dealing with pre-consumer scrap, two options may be applied. Each TS shall identify and include in the OEFSR which option shall be used when modelling pre-consumer scrap.

- **Option 1**: the impacts to produce the input material that lead to the pre-consumer scrap in question have to be allocated to the product system that generated this scrap. Scrap is

claimed as pre-consumer recycled content. Process boundaries and modelling requirements applying the CFF are shown in Figure 9.

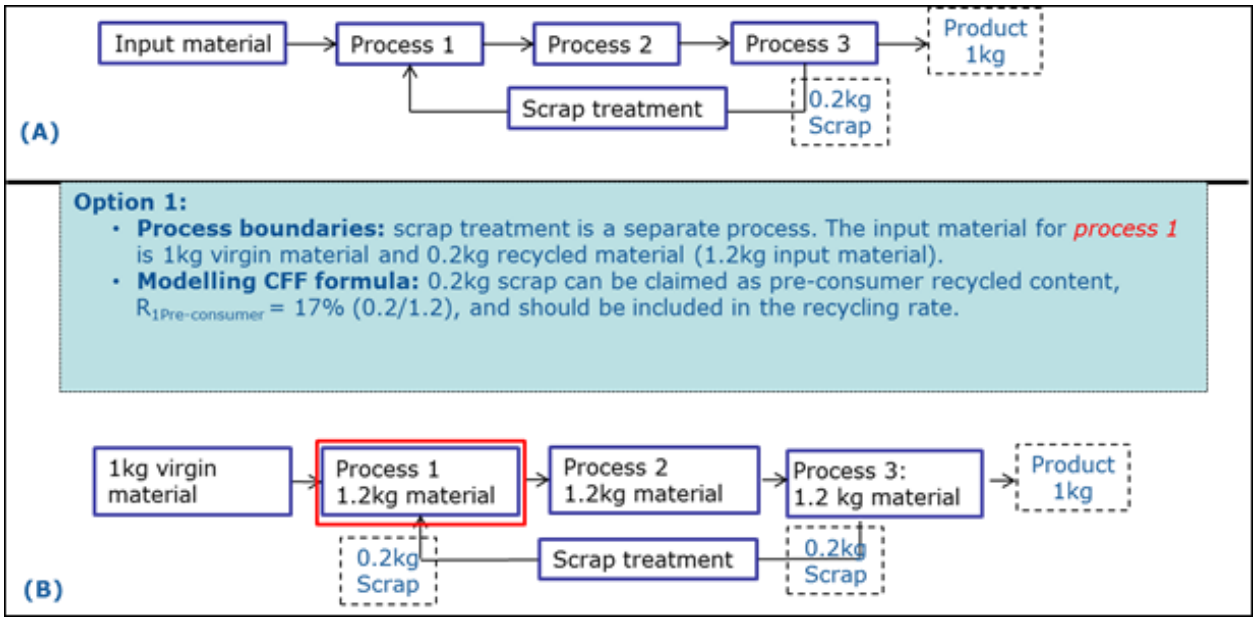

Figure 9. Modelling option when pre-consumer scrap is claimed as pre-consumer recycled content

- **Option 2**: Any material that circulates within a process chain or pool of process chains is excluded from being defined as recycled content and it is not included in R_1. Scrap is not claimed as pre-consumer recycled content. Process boundaries and modelling requirements applying the CFF are shown in Figure 10.

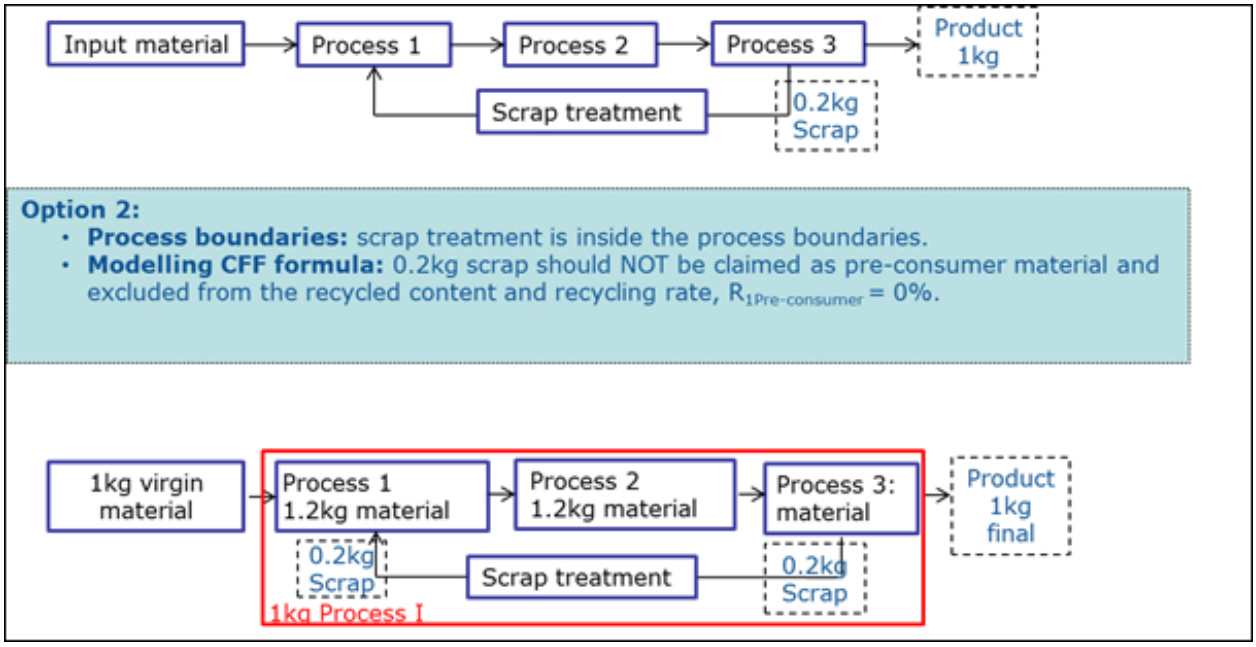

Figure 10. Modelling option when pre-consumer scrap is not claimed as pre-consumer recycled content

7.18.8 Recycling output rate (R_2)

Default R_2 values are available in Annex C. The OEFSR shall list the default R_2 values (with reference to Annex C - List of default values for A, R_1, R_2, R_3) to be used by the applicant in case no company-specific values are available. If an R_2 value is not available for a specific application in Annex C - List of default values for A, R_1, R_2, R_3 the OEFSR shall list the R_2 values of the material (e.g. materials average). In case no R_2 values are available, R_2 shall be set equal to 0 or new statistics may be generated by the TS in order to assign an R_2 value. Proposals to include new or updated values of R_2 in Annex C - List of default values for A, R_1, R_2, R_3 will be evaluated by the Commission. The list of R_2 values in the Annex C - List of default values for A, R_1, R_2, R_3 will be periodically reviewed and updated by the Commission.

The following procedure shall be followed by the applicant to select the right R_2 value:

- Company-specific values shall be used when available.
- If no company-specific values are available and the criteria for evaluation of recyclability are fulfilled (see below), application-specific R_2 values shall be used as listed in the OEFSR,
    - If an R_2 value is not available for a specific country, then the European average shall be used.
    - If an R_2 value is not available for a specific application, the R_2 values of the material shall be used (e.g. materials average).
    - In case no R_2 values are available, R_2 shall be set equal to 0 or new statistics may be generated in order to assign an R_2 value in the specific situation.
- The applied R_2 values shall be subject to the OEF study verification.

A visual representation of the output recycling rate is given in Figure 11. Often, values are available for point 8 in Figure 11, therefore such values shall be corrected to the actual output recycling rate (point 10). In Figure 11 the output recycling rate (R2) is in correspondence of point 10.

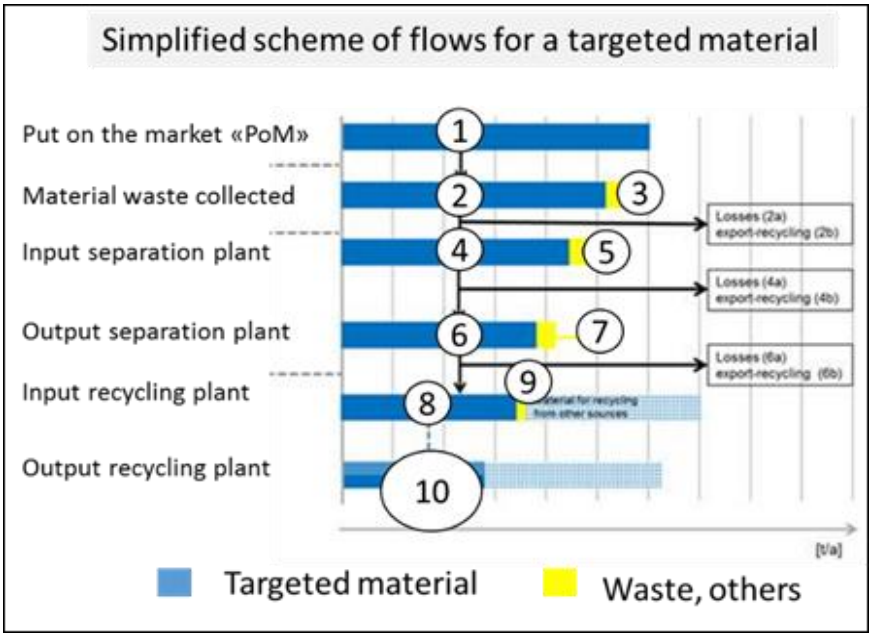

Figure 11. Simplified collection recycling scheme of a material. The output recycling rate (R_2) is in correspondence of point 10

The product design and composition will determine if the material in the specific product is actually suitable for recycling and thus falls within the values available in Annex C - List of default values for A, R_1, R_2, R_3 Therefore, before selecting the appropriate R_2 value, an evaluation for recyclability of the material shall be done and the OEF report shall include a statement on the recyclability of the materials/products:

The statement on the recyclability shall be provided together with an evaluation for recyclability that includes evidence for the following three criteria (as described by *ISO 14021:1999, section 7.7.4* 'Evaluation methodology'):

1. The collection, sorting and delivery systems to transfer the materials from the source to the recycling facility are conveniently available to a reasonable proportion of the purchasers, potential purchasers and users of the product;
2. The recycling facilities are available to accommodate the collected materials;
3. Evidence is available that the product for which recyclability is claimed is being collected and recycled.

Point 1 and 3 can be proven by recycling statistics (country specific) derived from industry associations or national bodies. Approximation to evidence at point 3 can be provided by applying for example the design for recyclability evaluation outlined in EN 13430 Material recycling (Annexes A and B) or other sector-specific recyclability guidelines if available[76].

[76] E.g. the EPBP design guidelines (http://www.epbp.org/design-guidelines), or Recyclability by design (http://www.recoup.org/)

Following the evaluation for recyclability, the appropriate R_2 values (supply-chain specific or provided in Annex C - List of default values for A, R1, R2, R3) shall be used.

If one criterion is not fulfilled or the sector-specific recyclability guidelines indicate a limited recyclability: an R_2 value of 0% shall be applied.

7.18.9 $E_{recycled}$ and $E_{recyclingEoL}$

The system boundary of E_{rec} and E_{recEoL} shall consider all the emissions and resources consumed starting from collection up to the defined point of substitution.

If the point of substitution is identified at "level 2" E_{rec} and E_{recEoL} shall be modelled using the real input flows. Therefore, if a portion of the input flows are from primary raw materials, they shall be included in the datasets used to model E_{rec} and E_{recEoL}.

In some cases E_{rec} can correspond to E_{recEoL}, for example in cases where close loops occurs.

The OEFSR shall list the default datasets that shall be used by the applicant to model E_{rec} and E_{recEoL}.

7.18.10 The E*v

When default E*v equals Ev, it is assumed that a recyclable material at end-of-life is replacing the same virgin material than where the recyclable material is produced from (at input side).

In some cases E*v will be different from Ev, when evidence is provided that a recyclable material is substituting a different virgin material than where the recyclable material is produced from.

When E*v ≠ Ev, E*v represents the actual amount of virgin material substituted by the recyclable material. In such cases E*v is not multiplied by Qs_{out}/Qp, because this parameter is indirectly taken into account when calculating the "actual amount" of virgin material substituted: such amount shall be calculated taking into account that the virgin material substituted and the recyclable material fulfil the same function, in terms of "how long" and "how well". E*v shall be determined based on evidence of actual substitution of the selected virgin material.

The OEFSR shall list the default datasets that shall be used by the applicant to model of E*v and Ev.

7.18.11 How to apply the CFF with a PP related to final products

When the formula is applied to final products, the OEFSR shall prescribe:

- The use of Equation 18 (CFF)
- The default A values of the specific application or material.

7.18.12 How to apply the CFF with a PP related to intermediate products

In cradle-to-gate studies the parameters related to the end-of-life of the product (i.e. recyclability at end-of-life, energy recovery, and disposal) shall not be accounted for, unless the OEFSR requires to calculate additional information from the EoL stage.

When the formula is applied in OEF studies with intermediate products (cradle-to-gate studies), the OEFSR shall prescribe:

- The use of Equation 18 (CFF)
- To exclude the end-of-life by setting the parameters R_2, R_3, and E_d equal to 0, for the products in scope.
- To use and report the OEF profile with A = 1 for the products in scope
- If possible, the OEFSR may prescribe default A values for specific applications and request reporting the application-specific OEF results as 'additional technical information'.

7.18.13 How to apply the CFF with a PP related to construction products

When the formula is applied to the full life cycle of a construction product, the OEFSR shall prescribe:

- The use of Equation 18 (CFF) or Equation 19 (CFF-M),
- Default A values of the specific application or material.

When the formula is applied to intermediate construction products, the OEF profile shall be calculated as follows:

- The “production burdens” part of Equation 19 (CFF-M) shall be used.
- The OEFSR may request to include the OEF profile of the “Burdens and benefits related to secondary materials input” part of Equation 19 (CFF-M), with application specific A values provided in the OEFSR. This information shall then be provided as ‘additional technical information’.

7.18.14 Summary table on how to apply the Circular Footprint Formula

Table 30 provides a summary on how to apply the CFF, depending on a study focusing on final products, intermediate products or construction products.

Table 30. Summary table on how to apply the CFF in different situations

Formula		Products apart from construction products		Construction products	
		Final products	*Intermediates*	*Full life cycle*	*Intermediates*

1) CFF					
	A = 1		X (hotspot and PEF profile)		
	A = default	X	X (optional as additional technical info.)		
2) CFF-M					
	A= default (All modules)			X	
	Production burdens				X
	Burdens and benefits related to secondary materials input, A=default				X (optional as additional technical info.)

7.18.15 How to deal with specific aspects

7.18.15.1 Biogenic carbon

When modelling bio-based products, biogenic carbon shall be modelled according to the requirements listed in section 7.9.

7.18.15.2 Recovery bottom ashes/slag from incineration

Recovery of bottom ashes/slag shall be included in the R_2 value (recycling output rate) of the original product/material. Their treatment is within the E_{recEoL}.

7.18.15.3 Landfill and incineration with energy recovery

Whenever a process, such as landfill with energy recovery or municipal solid waste incineration with energy recovery, is leading to an energy recovery it shall be modelled under the "energy" part in Equation 18 (CFF). The credit is calculated based on the amount of output energy that is sold.

7.18.15.4 Municipal solid waste

Default values per country are provided in Annex C - List of default values for A, R_1, R_2, R_3 and shall be used to quantify the share to landfill and the share to incineration, unless supply-chain specific values are available.

7.18.15.5 Compost and anaerobic digestion/sewage treatment

Compost, including digestate coming out of the anaerobic digestion, shall be treated in the "material" part of CFF as recycling with A = 0.5. The energy part of the anaerobic digestion shall be treated as a normal process of energy recovery under the "energy" part of Equation 18 (CFF).

7.18.15.6 Waste materials used as a fuel

When a waste material is used as a fuel (e.g., waste plastic used as fuel in cement kilns), it shall be treated as an energy recovery process under the “energy” part of Equation 18 (CFF).

7.18.15.7 Modelling complex products

When considering complex products (e.g., printed wiring boards PWB) with complex end-of-life management, the default datasets for end-of-life treatment processes should already implement the CFF. The default values of the parameters shall refer to the ones in Annex C - List of default values for A, R1, R2, R3 and shall be available as metadata information in the dataset. The Bill of Material (BoM) should be taken as a starting point for calculations if no default data is available.

7.18.15.8 Reuse and refurbishment

If the reuse/refurbishment of a product results into a product with different product specifications (providing another function), this shall be considered as part of the CFF, as a form of recycling (see section 7.8). Also, old parts that have been changed during refurbishment shall be modelled under the CFF.

In this case, reuse/refurbishment activities are part of the E_{recEoL} parameter, while the alternative function provided (or the avoided production of parts or components) falls under the E*v parameter.

7.18.15.9 Packaging

Qs/Qp values for packaging

Quality ratios are always OEFSR specific, except for packaging. The packaging materials used by industry are often the same within different sectors and product groups. Therefore, consistency is also needed in the quality ratios used within the CFF. Annex C provides one worksheet with Qs/Qp values applicable to packaging materials. The values are derived from the document "PEF-OEF_EOL DefaultData_V1.2_uploaded", used within the pilot phase. These values are based on user experiences and have no literature references.

Each OEFSR should use the default values provide here. The TS may decide to change the default values if this is justified in the OEFSR.

Recycled content (R_1) for packaging:

When using supply-chain-specific R_1 values, traceability throughout the supply chain is necessary and supplementary information is required. For the packaging industry, the following industry-specific guidelines are recommended:

- For the container glass industry (FEVE - The European Container Glass Federation): the European Commission regulation no 1179/2012. This regulation requests a statement of conformity delivered by the cullet producer.
- For the paper industry: European Recovered Paper Identification System (CEPI, 2008). This document prescribes rules and guidance on necessary information and steps, with a delivery note that shall be received at the reception of the mill.

- For beverage cartons no recycled content is used so far and thus sector specific rules are redundant so far. However, if needed, the same guidelines as paper shall be used as being most suitable (beverage cartons are covered by a recovered paper grade category under EN643).
- For the plastics industry: EN standard 15343:2007. This standard prescribes rules and guidelines on traceability. The supplier of the recyclate is requested to provide specific information.

Recycling output rate (R_2) for packaging:

Background information used to calculate R_2 values for packaging is reported in Annex C. Table 31 presents per packaging application the corresponding material and default R_2 data source to be used, as available in Annex C. The R_2 values may only be used after making an evaluation for recyclability based on three criteria (as described by ISO 14021:1999 and in section 7.18.8). Sector-specific recyclability guidelines may be used to show that a certain product is collected and recycled. For PET bottles the EPBP guidelines should be used (epbp.org/design-guidelines), while for generic plastics the recyclability by design should be used (www.recoup.org).

Table 31. Data source for R_2 per packaging application

Packaging application	Material	Data source R_2 (see Annex D)
Bag in Box - High barrier EVOH	Packaging film	Generic plastic packaging
Bag in Box - High barrier EVOH	HDPE tap	PET bottle
Bag in Box - High barrier EVOH	Corrugated board	Paper and cardboard
Aseptic beverage carton	Aluminium foil	Aluminium, Liquid beverage carton
Aseptic beverage carton	LDPE film	Generic plastics, Liquid beverage carton
Aseptic beverage carton	Liquid Packaging Board	Paper and cardboard, Liquid beverage carton
Beverage carton	LDPE film	Generic plastics, Liquid beverage carton
Beverage carton	Liquid Packaging Board	Paper and cardboard, Liquid beverage carton
Closure - Plastic cap PP	PP granulates	Generic plastic packaging
Closure - Plastic cap HDPE	HDPE granulates	PET bottle
Closure - Alu-Ring pull	Aluminium sheet	Aluminium cans
Closure - Alu-Screw cap	Aluminium foil	Aluminium cans
Closure - Tin plated steel	Tin plated steel (ETP)	Steel for packaging
Closure - ESSC steel-Pry off	Tin free steel (ECCS)	Steel for packaging
Closure - plastic cork stopper	LDPE cork	Generic plastic packaging
Crates - Plastic, HDPE	HDPE granulates	Generic plastic packaging

Crates - Plastic, PP	PP granulates	Generic plastic packaging
Packaging film - High barrier	PET/ALU/PE film	Generic plastic packaging
Packaging film - Medium barrier	PP film PP film	Generic plastic packaging
Packaging film - Low barrier	PP film PP film	Generic plastic packaging
Packaging film - High barrier PE/EVOH/PE	PE film EVOH film LDPE film	Generic plastic packaging
Flexible paper packaging	Kraft paper - uncoated	Paper and cardboard
Glass bottle, unspecified colour	Glass, unspecified colour	Container glass, unspecified colour
Glass bottle, colourless (flint)	Glass, unspecified colour	Container glass, colourless (flint)
Glass bottle, green colour	Glass, unspecified colour	Container glass, green colour
Glass bottle, amber colour	Glass, unspecified colour	Container glass, amber colour
Label - Plastic self-adhesive	PP film	PET bottle
Label - Plastic wrap around	OPP film	PET bottle
Label - Alu label Neck Foil	Aluminium foil	Aluminium cans
Label - Paper	Kraft paper - uncoated	Paper and cardboard
Label - Plastic	PE film	Generic plastic packaging
Plastic - Shrink Sleeve PET	PET film	PET bottle
Plastic - Shrink Sleeve PVC	PVC film	PET bottle
Plastic - Shrink Sleeve OPS	PS film	PET bottle
Can beverage - sanitary end aluminium	Aluminium sheet	Aluminium cans
Can beverage - body aluminium	Aluminium sheet	Aluminium cans
Can beverage - body steel	Tin plated steel (ETP)	Steel for packaging
Can Food - sanitary end aluminium	Aluminium sheet	Aluminium cans
Can Food - sanitary end tin plated steel	Tin plated steel (ETP)	Steel for packaging
Can Food - body ESSC	Tin free steel (ECCS)	Steel for packaging
Can Food - body aluminium	Aluminium sheet	Aluminium cans
Can Food - body tin plated steel	Tin plated steel (ETP)	Steel for packaging
Can - body ECCS PET coated	Tin free steel (ECCS)	Steel for packaging
Can - sanitary end ECCS PET coated	Tin free steel (ECCS)	Steel for packaging
Can non-food - body tin plated steel -	Tin plated steel (ETP)	Steel for packaging

coated		
Can non-food - sanitary end tin plated steel	Tin plated steel (ETP)	Steel for packaging
Can non-food - body tin plated steel	Tin plated steel (ETP)	Steel for packaging
Aluminium tray	Aluminium foil	Aluminium cans
Pallet - Plastic, 80x120	HDPE granulates	Generic plastic packaging
Pallet - Plastic, 100x120	HDPE granulates	Generic plastic packaging
Pallet - Plastic, half	HDPE granulates	Generic plastic packaging
Paper sack	Sack kraft paper	Paper, Paper sack
Paper bag	Kraft paper - uncoated	Paper, Paper bag
Carton - box / inserts	Carton board	Paper, Carton - box / inserts
Solid board box	Solid board	Paper, Solid board box
Solid board box - bleached	Solid bleached board	Paper, Solid board box - bleached
Corrugated - pads / box / inserts	Corrugated board	Paper, Corrugated - pads / box / inserts
PET bottle transparent	PET granulates, bottle grade	PET bottle
PET Preform transparent	PET granulates, bottle grade	PET bottle
Plastic film - PET	PET film	Generic plastic packaging
Plastic film - PE	PE film	Generic plastic packaging
Plastic film - PP	PP film	Generic plastic packaging
Plastic film - OPP	PP film	Generic plastic packaging
Plastic film - PP strapping	PP film	Generic plastic packaging
Plastic film - PE wrapping	PE film	Generic plastic packaging
Plastic - Shrink wrap	LDPE film	Generic plastic packaging
Plastic - Stretch film	LLDPE film	Generic plastic packaging
Plastic bag - PE bag	PE film	Generic plastic packaging
Plastic bag - Dry food	PP film	Generic plastic packaging
Plastic bag - Dry food	LDPE film	Generic plastic packaging
Slip-sheet / Plastic divider	LDPE granulates	Generic plastic packaging
Plastic Can - body PP	PP granulates	Generic plastic packaging
Plastic Can - sanitary end PP	PP granulates	Generic plastic packaging

Plastic Can - body HDPE	HDPE granulates	Generic plastic packaging
Plastic Can - sanitary end HDPE	HDPE granulates	Generic plastic packaging
Plastic tray - Polypropylene	PP granulates	Generic plastic packaging
Corner foam - polyethylene	LDPE granulates	Generic plastic packaging
Corner foam - polystyrene	EPS beads	Generic plastic packaging
HDPE tap	HDPE granulates	Generic plastic packaging

7.19 Data requirements and quality requirements

7.19.1 The materiality approach

One of the main features of the OEF Guide is the attempt to operationalise the "materiality" approach, i.e. focusing where it really matters. In the OEF context, the materiality approach is developed around two main areas:

- **Impact categories, life cycle stages, processes and elementary flows**: the OEFSR shall identify the most relevant ones. These should be the contributions where companies, stakeholders, consumers, and policy makers should focus;
- **Data requirements**: as the most relevant processes are those driving the environmental profile of a sector, these shall be assessed by using data with higher quality compared to the less relevant processes, independently from where these processes happen in the sector.

Once the model(s) for the representative organization(s) is developed, the TS shall address the following two questions:

1. Which are the processes that are driving the environmental profile of the organization (most relevant processes)?
2. Which are the processes for which company-specific information is mandatory?

7.19.2 DQR formula

Within the EF context, the data quality of each dataset and the total EF study shall be calculated and reported. The calculation of the DQR shall be based on 4 data quality criteria:

$$DQR = \frac{TeR+GR+TiR+P}{4} \qquad \text{[Equation 20]}$$

where TeR is the Technological-Representativeness, GR is the Geographical-Representativeness, TiR is the Time-Representativeness, and P is the Precision/uncertainty. The representativeness (technological, geographical and time-related) characterises to what degree the processes and products selected are depicting the system analysed, while the precision indicates the way the data is derived and related level of uncertainty. The OEFSR shall provide tables with the criteria to be

used for the semi-quantitative assessment of each quality criteria. The OEFSR may specify more stringent data quality requirements if appropriate for the sector in question and specify additional criteria for the assessment of data quality.

When a company-specific dataset is created, the data quality of the company-specific activity data, the company specific emission data and secondary sub-processes shall be assessed separately. The DQR of the newly developed dataset shall be calculated as follow:

1) Select the most relevant processes and direct elementary flows that account for at least 80% of the total environmental impact of the company-specific dataset, listing them from the most contributing to the least contributing one.

2) Calculate the DQR criteria TeR, TiR, GR and P for each most relevant process and each most relevant direct elementary flow. The values of each criteria shall be assigned based on the table on how to assess the value of the DQR criteria for the processes provided in the OEFSR.

2.a) Each most relevant elementary flow consists of the amount and elementary flow naming (e.g. 40 g carbon dioxide). For each most relevant elementary flow, the applicant of the OEFSR shall evaluate the 4 DQR criteria named $Te_{R\text{-}EF}$, $Ti_{R\text{-}EF}$, $G_{R\text{-}EF}$, and PEF. It shall be evaluated for example, the timing of the flow measured, for which technology the flow was measured and in which geographical area.

2.b) Each most relevant process is a combination of activity data and the secondary dataset used. For each most relevant process, the DQR is calculated by the applicant of the OEFSR as a combination of the 4 DQR criteria for activity data and the secondary dataset: (i) Ti_R and P shall be evaluated at the level of the activity data (named $Ti_{R\text{-}AD}$, P_{AD}) and (ii) Te_R, Ti_R and G_R shall be evaluated at the level of the secondary dataset used (named $Te_{R\text{-}SD}$, $Ti_{R\text{-}SD}$ and $G_{R\text{-}SD}$). As Ti_R is evaluated twice, the mathematical average of $Ti_{R\text{-}AD}$ and $Ti_{R\text{-}SD}$ represents the Ti_R of the most relevant process.

2.c) Considering that the data for the mandatory processes shall be company specific, the score of P cannot be higher than 3 while the score for TiR, TeR, and GR cannot be higher than 2 (The DQR score shall be ≤1.6).

3) Calculate the environmental contribution of each most-relevant process and elementary flow to the total environmental impact of all most-relevant processes and elementary flows, in % (weighted using 13 EF impact categories, with the exclusion of the 3 toxicity-related ones). For example, the newly developed dataset has only two most relevant processes, contributing in total to 80% of the total environmental impact of the dataset:

- Process 1 carries 30% of the total dataset environmental impact. The contribution of this process to the total of 80% is 37.5% (the latter is the weight to be used).
- Process 1 carries 50% of the total dataset environmental impact. The contribution of this process to the total of 80% is 62.5% (the latter is the weight to be used).

4) Calculate the Te_R, Ti_R, G_R and P criteria of the newly developed dataset as the weighted average of each criteria of the most relevant processes and direct elementary flows. The weight is the relative contribution (in %) of each most relevant process and direct elementary flow calculated in step 3.

5) The applicant of the OEFSR shall calculate the total DQR of the newly developed dataset using Equation 21, where $\overline{Te_R}, \overline{G_R}, \overline{Ti_R}, \bar{P}$ are the weighted average calculated as specified in point (4).

$$DQR = \frac{\overline{Te_R}+\overline{G_R}+\overline{Ti_R}+\bar{P}}{4} \quad \text{[Equation 21]}$$

NOTE: in case the newly developed dataset has most relevant processes filled in by non-EF compliant datasets (and thus without DQR), then these datasets cannot be included in step 4 and 5 of the DQR calculation. (1) The weight of step 3 shall be recalculated for the EF-compliant datasets only. Calculate the environmental contribution of each most-relevant EF compliant process and elementary flow to the total environmental impact of all most-relevant EF compliant processes and elementary flows, in %. Continue with step 4 and 5. (2) The weight of the non-EF compliant dataset (calculated in step 3) shall be used to increase the DQR criteria and total DQR accordingly. For example:

- Process 1 carries 30% of the total dataset environmental impact and is ILCD entry level compliant. The contribution of this process to the total of 80% is 37.5% (the latter is the weight to be used).
- Process 1 carries 50% of the total dataset environmental impact and is EF compliant. The contribution of this process to all most-relevant EF compliant processes is 100%. The latter is the weight to be used in step 4.
- After step 5, the parameters $\overline{\mathrm{Te_R}}, \overline{\mathrm{G_R}}, \overline{\mathrm{Ti_R}}, \overline{\mathrm{P}}$ and the total DQR shall be multiplied with 1.375.

7.19.2.1 DQR tables for processes with company-specific data:

To allow the evaluation of the DQR of processes for which company-specific data are used, the OEFSR shall include at least one table on how to assess the value of the DQR criteria for these processes. The table(s) to be included in the OEFSR shall be based on Table 32. Only the reference years for Ti_R ($Ti_{R\text{-}EF}$ **and** $Ti_{R\text{-}AD}$ and $Ti_{R\text{-}SD}$) might be adapted by the TS. It is not allowed to modify the text for the other criteria.

Table 32. How to assign the DQR criteria when using company-specific information.

	P_{EF} **and** P_{AD}	$Ti_{R\text{-}EF}$ **and** $Ti_{R\text{-}AD}$	$Ti_{R\text{-}SD}$	$Te_{R\text{-}EF}$ **and** $Te_{R\text{-}SD}$	$G_{R\text{-}EF}$ **and** $G_{R\text{-}SD}$
1	Measured/calculated and externally verified	The data refers to the most recent annual administration period with respect to the EF report publication date	The EF report publication date happens within the time validity of the dataset	The elementary flows and the secondary dataset reflect exactly the technology of the newly developed dataset	The data(set) reflects the exact geography where the process modelled in the newly created dataset takes place

2	Measured/calculated and internally verified, plausibility checked by reviewer	The data refers to maximum 2 annual administration periods with respect to the EF report publication date	The EF report publication date happens not later than 2 years beyond the time validity of the dataset	The elementary flows and the secondary dataset is a proxy of the technology of the newly developed dataset	The data(set) partly reflects the geography where the process modelled in the newly created dataset takes place
3	Measured/calculated/literature and plausibility not checked by reviewer OR Qualified estimate based on calculations plausibility checked by reviewer	The data refers to maximum three annual administration periods with respect to the EF report publication date	Not applicable	Not applicable	Not applicable
4-5	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

P_{EF}: Precision for elementary flows; **P_{AD}**: Precision for activity data; **$Ti_{R\text{-}EF}$**: Time Representativeness for elementary flows; **$Ti_{R\text{-}AD}$**: Time representativeness for activity data; **$Ti_{R\text{-}SD}$**: Time representativeness for secondary datasets; **$Te_{R\text{-}EF}$**: Technology representativeness for elementary flows; **$Te_{R\text{-}SD}$**: Technology representativeness for secondary datasets**;** **$G_{R\text{-}EF}$**: Geographical representativeness for elementary flows; **$G_{R\text{-}SD}$:** Geographical representativeness for secondary datasets.

7.19.2.2 DQR for processes in which secondary datasets are used:

To allow the applicant to assess the context-specific DQRs criteria Te_R, Ti_R, G_R of most relevant processes, the OEFSR shall include at least one table on how to assess the criteria. The assessment of the Te_R, Ti_R and G_R criteria shall be based on Table 33. Only the reference years for Ti_R might be adapted by the TS, per process. It is not allowed to modify the text for the other criteria.

Table 33. How to assign the values to parameters in the DQR formula when secondary datasets are used.

	Ti_R	**Te_R**	**G_R**
1	The EF report publication date happens within the time validity of the dataset	The technology used in the EF study is exactly the same as the one in scope of the dataset	The process modelled in the EF study takes place in the country the dataset is valid for
2	The EF report publication date happens not later than 2 years beyond the time validity of the dataset	The technologies used in the EF study is included in the mix of technologies in scope of the dataset	The process modelled in the EF study takes place in the geographical region (e.g. Europe) the dataset is valid for
3	The EF report publication date happens not later than 4 years beyond the time validity of the dataset	The technologies used in the EF study are only partly included in the scope of the dataset	The process modelled in the EF study takes place in one of the geographical regions the dataset is valid for
4	The EF report publication date happens not later than 6 years beyond the time validity of the dataset	The technologies used in the EF study are similar to those included in the scope of the dataset	The process modelled in the EF study takes place in a country that is not included in the geographical region(s) the dataset is valid for, but sufficient similarities are estimated based on expert judgement.

5	The EF report publication date happens later than 6 years after the time validity of the dataset	The technologies used in the EF study are different from those included in the scope of the dataset	The process modelled in the EF study takes place in a different country than the one the dataset is valid for

7.19.3 List of mandatory company-specific data

The list of mandatory company-specific data refers to the activity data and (unit) processes for which company-specific data shall be collected. This list defines the minimum requirements to be fulfilled by companies that apply the OEFSR. The purpose is to avoid that an applicant without access to the relevant company-specific data is able to perform an OEF study and communicate its results by only applying default data and datasets. The OEFSR shall define the list of mandatory data.

For the selection of the mandatory data, the TS shall consider its relevance within the EF profile, the level of effort needed to collect these data (especially for SMEs) and the overall quantity of data / time required to collect all mandatory company-specific data. This is very important and has two consequences: (i) companies may perform an OEF study by only searching for these data and using default data for everything outside this list, while (ii) companies who don't have company-specific data for one listed cannot establish an OEFSR-compliant EF profile of the organisation in scope.

For each process for which company-specific data is mandatory the developed dataset shall be EF compliant and the OEFSR shall provide the following information:

1. the list of the activity data to be declared by the applicant together with the default secondary datasets to be used. The list of activity data shall be as specific as possible in terms of unit of measures and any other characteristics that could help the applicant in implementing the OEFSR;

2. the list of foreground elementary flows to be declared by the applicant. This is the list of most relevant direct emissions defined in the screening study. For each emission the OEFSR shall specify the frequency of measurements, the measurement methods and any other technical information necessary to ensure that the calculations of the OEF-profile are comparable.

Considering that the data for the mandatory processes shall be company specific, the score of P cannot be higher than 3 while the score for TiR, TeR, and GR cannot be higher than 2 (the DQR score shall be ≤1.6). To assess the DQR the rules described in section 7.19.4 apply. T

For those processes selected as to be modelled with company-specific information, the OEFSR shall follow the requirements set out in this section. For all other processes, the applicant shall apply the Data Needs Matrix as explained in 7.19.4.

7.19.4 Data needs matrix (DNM)

All processes required to model the product and outside the list of mandatory company-specific shall be evaluated using the Data Needs Matrix (see Table 34). The next section includes the rules to be followed when developing an OEFSR, while section 7.19.4.2 includes the rules for the applicant of the OEFSR.

7.19.4.1 Rules to be followed when developing an OEFSR

The OEFSR shall include the following information for all processes outside the list of mandatory company-specific data:

1. provide the list of default secondary datasets to be used within the scope of the OEFSR, dataset name together with the UUID of the aggregated version[77] and the node web address;
2. report the default DQR values (for each criteria) as provided in their meta data, for all default EF datasets listed;
3. indicate the most relevant processes;
4. provide one or more DQR table(s) for the most relevant processes;
5. indicate the processes expected to be in situation 1;
6. for those processes expected to be in situation 1, provide the list of activity data and elementary flows to be declared by the applicant. This list shall be as specific as possible in terms of unit of measurement, averaging data and any other characteristics that could help the applicant in implementing the OEFSR.

7.19.4.2 Rules for the applicant

The DNM shall be used by the OEFSR applicant to evaluate which data is needed and shall be used within the modelling of its OEF, depending on the level of influence the applicant (company) has on the specific process. The following three cases are be found in the DNM and are explained below:

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

A company implementing the OEFSR shall:

[77] Each EF compliant dataset tendered by the EC is available in both an aggregated and disaggregated (at level-1) form.

1. determine the level of influence (Situation 1, 2 or 3 described below) the company has for each process in its supply chain. This decision determines which of the options in Table 34 is pertinent for each process;
2. follow the rules of Table 34 for the most relevant processes and for the other processes.
3. calculate/re-evaluate the DQR values (for each criterion + total) for all the datasets used for the most relevant processes and the new ones created. For all remaining 'other processes' the values reported in the OEFSR shall be used.
4. if one or more processes are not included in the list of default processes in the OEFSR, then the applicant shall identify a suitable dataset according to requirements provided in section 7.19.5.

Table 34. Data Needs Matrix (DNM) – Requirements for the applicant of the OEFSR. The options indicated for each situation are not listed in hierarchical order.

		Most relevant process	Other process
Situation 1: process run by the company applying the OEFSR	**Option 1**	Provide company-specific data (as requested in the OEFSR) and create a company specific dataset partially disaggregated at least at level 1 (DQR ≤1.6). Calculate the DQR values (for each criterion + total)	
	Option 2		Use default secondary dataset in OEFSR, in aggregated form (DQR ≤3.0). Use the default DQR values
Situation 2: process not run by the company applying the OEFSR but with access to (company-)specific information	**Option 1**	Provide company-specific data (as requested in the OEFSR) and create a company specific dataset partially disaggregated at least at level 1 (DQR ≤1.6). Calculate the DQR values (for each criterion + total)	
	Option 2	Use company-specific activity data for transport (distance), and substitute the sub-processes used for electricity mix and transport with supply-chain specific EF compliant datasets (DQR ≤3.0). Re-evaluate the DQR criteria within the product specific context	
	Option 3		Use company-specific activity data for transport (distance), and substitute the sub-processes used for electricity mix and transport with supply-chain specific EF compliant datasets (DQR ≤4.0). Re-evaluate the DQR criteria within the product specific context
Situation 3: process not run by the company applying the OEFSR and without access to (company)-specific information	**Option 1**	Use default secondary dataset, in aggregated form (DQR ≤3.0). Re-evaluate the DQR criteria within the product specific context	
	Option 2		Use default secondary dataset in OEFSR, in aggregated form (DQR ≤4.0) Use the default DQR values

7.19.4.3 DNM, situation 1

For each process in situation 1 there are two possible options:

- The process is in the list of most relevant processes as specified in the OEFSR or is not in the list of most relevant process, but still the company wants to provide company specific data (option 1);

- The process is not in the list of most relevant processes and the company prefers to use a secondary dataset (option 2).

Situation 1/Option 1

For all processes run by the company and where the company applying the OEFSR uses company specific data. The DQR of the newly developed dataset shall be evaluated as described in section 7.19.2 while using the OEFSR specific DQR tables.

Situation 1/Option 2

For the non-most relevant processes only, if the applicant decides to model the process without collecting company-specific data, then the applicant shall use the secondary dataset listed in the OEFSR together with its default DQR values listed in the OEFSR.

If the default dataset to be used for the process is not listed in the OEFSR, the applicant of the OEFSR shall take the DQR values from the metadata of the original dataset.

7.19.4.4 DNM, situation 2

When a process is in situation 2 (i.e. the company applying the OEFSR is not running the process but has access to company-specific data) there are three possible options:

- The company applying the OEFSR has access to extensive supplier-specific information and wants to create a new EF-compliant dataset[78] (Option 1);
- The company has some supplier-specific information and want to make some minimum changes (Option 2).
- The process is not in the list of most relevant processes and the company prefers to use a secondary dataset (option 3).

Situation 2/Option 1

For all processes run by the company and where the company applying the OEFSR uses company specific data. The DQR of the newly developed dataset shall be evaluated as described in section 7.19.2 while using the OEFSR specific DQR tables.

Situation 2/Option 2

Company-specific activity data for transport are used and the sub-processes used for electricity mix and transport with supply-chain specific EF compliant datasets are substituted starting from the default secondary dataset provided in the OEFSR.

[78] The review of the newly created dataset is optional

Please note that, the OEFSR lists all dataset names together with the UUID of their aggregated dataset. For this situation, the disaggregated version of the dataset is required.

The applicant of the OEFSR shall recalculate the DQR criteria for the processes in Situation 2, Option 2. It shall make the DQR context-specific by re-evaluating Te_R, Ti_R and G_R using the table(s) provided in the OEFSR (adapted from Table 33). The criteria G_R shall be lowered by 30%[79] and the criteria P shall keep the original value.

Situation 2/Option 3

Company-specific activity data for transport are used and the sub-processes used for electricity mix and transport with supply-chain specific EF compliant datasets are substituted starting from the default secondary dataset provided in the OEFSR.

In this case, the applicant of the OEFSR shall recalculate the DQR for the processes by taking the DQR values from the dataset and lowering the parameter G_R by 30%.

7.19.4.5 DNM, situation 3

When a process is in situation 3 (i.e. the company applying the OEFSR is not running the process and this company does not have access to company-specific data), there are two possible options:

- It is in the list of most relevant processes (situation 3, option 1)
- It is not in the list of most relevant processes (situation 3, option 2)

Situation 3/Option 1

In this case, the applicant of the OEFSR shall take the DQR values from the OEFSR.

If the default dataset used for the process is not listed in the OEFSR, the applicant of the OEFSR shall make the DQR criteria context-specific by re-evaluating Te_R, Ti_R and G_R using the table(s) provided in the OEFSR (adapted from Table 33**Error! Reference source not found.**). The parameter P shall keep the original value.

Situation 3/Option 2

For the non-most relevant processes, the applicant shall use the corresponding secondary dataset listed in the OEFSR together with its DQR values.

If the default dataset to be used for the process is not listed in the OEFSR, the applicant of the OEFSR shall take the DQR values from the original dataset.

[79] In situation 2, option 2 it is proposed to lower the parameter G_R by 30% in order to incentivize the use of company specific information and reward the efforts of the company in increasing the geographic representativeness of a secondary dataset through the substitution of the electricity mixes and of the distance and means of transportation.

7.19.5 Which datasets to use?

For the OEFSR screenings and supporting studies: the TS shall use EF-compliant datasets when available. In case an EF-compliant dataset does not exist, an EF-compliant proxy shall be used and if not available, a non-EF-compliant dataset may be used.

For the final OEF calculations of the representative organisation, the following rules shall be followed in hierarchical order:

1. An EF-compliant proxy is available: it shall be included in the list of default processes of the OEFSR and stated within the limitations chapter (See Annex B).
2. An ILCD-entry level-compliant (EL) proxy is freely available: it shall not be included in the list of default processes of the OEFSR. The proxy shall be listed in the data gaps of the OEFSR (See annex B) using the following text: "These datasets are used as proxy within the calculations of the representative product. However, the applicant of the OEFSR shall apply an EF-compliant dataset if available. If this is not available, the applicant shall use these proxies."
3. If no EF-compliant or ILCD-entry level-compliant proxy is freely available: it shall be excluded from the model. This shall be clearly stated in the OEFSR as a data gap (See Annex B).

Exception: Among the EF tendered datasets integrated modelling inconsistencies may arrive (e.g., glass default dataset uses 50/50 at input side, but then is modelled with CFF at output side; while plastics is fully modelled with CFF). The aim for consistency within the OEFSR is preferred. An ILCD-entry level-compliant dataset or proper modelling proxy may be chosen above an EF-compliant dataset to achieve consistency. This shall be justified in the OEFSR.

For the OEFSR applicant, the secondary datasets to be used are those listed in the OEFSR. Whenever a dataset needed to calculate the EF-profile is not among those listed, the following rules shall be followed in hierarchical order:

4. Use an EF-compliant dataset available on one of the following nodes:
    1. *http://eplca.jrc.ec.europa.eu/EF-node/*
    2. *http://lcdn.blonkconsultants.nl*
    3. *http://ecoinvent.lca-data.com*
    4. *http://lcdn-cepe.org*
    5. *https://lcdn.quantis-software.com/PEF/*
    6. *http://lcdn.thinkstep.com/Node*
5. Use an EF-compliant dataset available in a free or commercial source;
6. Use another EF-compliant dataset considered to be a good proxy. In such case this information shall be included in the "limitation" section of the OEF report.
7. Use an ILCD-entry level-compliant dataset. In such case this information shall be included in the "data gap" section of the OEF report.

7.19.6 The DQR of the study

The OEFSR shall require the calculation of the DQR of the EF study and the EF report shall report it.

In order to calculate the DQR of the EF study, the applicant shall calculate separately the TeR, TiR, GR and P for the EF study as the weighted average of all most relevant processes, based on their relative environmental contribution to the total single score (excluding the 3 toxicity-related ones). The detailed DQR calculation rules of section 7.19.2 shall be followed.

8 Verification and validation of EF studies, reports, and communication vehicles

8.1 Defining the scope of the verification

Verification and validation of the EF study is mandatory whenever the EF study, or part of the information therein, is used for any type of external communication (i.e. communication to any interested party other than the commissioner or the practitioner of the study).

Verification means the conformity assessment process carried out by an environmental footprint verifier to demonstrate whether the EF study has been carried out in compliance with the OEFSR it declares compliance with and/or the most updated version of the OEF method adopted by the Commission.

Validation means the confirmation by the environmental footprint verifier who carried out the verification, that the information and data included in the EF study, EF report and the communication vehicles are reliable, credible and correct.

The verification and validation shall cover the following three areas:

1. the EF study (including, but not limited to, the data collected, calculated, and estimated and the underlying model)
2. the EF report
3. the technical content of the communication vehicles.

The verification of the **EF study** shall ensure that:

- the EF study is conducted in compliance with the most recent OEFSR, if available;
- if an OEFSR is not available, the EF study is conducted in compliance with the most recent version of the OEFSR Guidance and the OEF method, all EF methodological requirements, including the use of the predefined characterisation, normalisation and weighting factors, are fulfilled;

The validation of information in the EF study shall ensure that:

- the data and information used for the EF study are consistent, reliable and traceable;
- the calculations performed do not include mistakes.

The verification and validation of the **EF report** shall ensure that:

- the EF report is complete, consistent, and compliant with the EF study template provided in the most recent version of the OEFSR Guidance;
- the information and data included are consistent, reliable and traceable;
- the mandatory information and sections are included and appropriately filled in;
- All the technical information that could be used for communication purposes, independently from the communication vehicle to be used, are included in the report;

Note: whilst confidential information may be excluded from the EF report, this information shall be subject to validation.

The validation of the **communication vehicle** content shall ensure that**:**

- The technical information and data included are reliable and consistent with the information included in the EF study and in the EF report.

8.2 Verification procedure

The verification procedure covers the following steps:

- First, the commissioner shall select the verifier or verification team following the rules outlined in section 8.3.1;
- Second, the verification is performed following the verification process described in section 8.4;
- Third, the verifier communicates to the commissioner any misstatements, non-conformities and need for clarifications (section 8.3.2), and drafts the validation statement (section 8.5.2);
- Fourth, the commissioner responds to the verifier's comments and introduces necessary corrections and changes (if needed) to ensure the final compliance of the EF study, EF report and EF communication vehicles. If, in the verifier's judgement, the commissioner does not respond appropriately within a reasonable time period, the verifier shall issue a modified validation statement or withdraw from the verification process;
- Fifth, the final validation statement is provided, considering (if needed) the corrections and changes introduced by the commissioner;
- Sixth, surveillance of the EF study respective the EF report is provided during the validity of the EF report (as defined in 8.5.3).

If a matter comes to the verifier's attention that causes the verifier to believe in the existence of fraud or noncompliance with laws or regulations, the verifier shall communicate this immediately to the commissioner of the study.

8.3 Verifier(s)

The verification/validation may be performed by a single verifier or by a verification team. In line with ISO 14025, the verifier(s) may be internal or external. In particular:

- for business to consumer (B2C) communications, the independent verifier(s) shall be external to the organisation that conducted the EF study;

- for business to business (B2B) communications, the independent verifiers may be either internal or external to the organisation that conducted the EF study.

In any case the independency of the verifiers shall be guaranteed (i.e. they shall fulfil the intentions in the requirements of ISO/IEC 17020:2012 regarding a 3th party verifier, they shall not have conflicts of interests on concerned products/sector and cannot include members of the Technical Secretariat or of the consultants involved in previous part of the work - screening studies, supporting studies, OEFSR review, etc.). The minimum requirements and score for the verifier(s) as specified below shall be fulfilled. If the verification/validation is performed by a single verifier, he/she shall satisfy all the minimum requirements and the minimum score; if the verification/validation is performed by a team, the team as a whole shall satisfy all the minimum requirements and the minimum score. The documents proving the qualifications of the verifier(s) shall be provided as annex to the verification report or they shall be made available electronically.

In case a verification team is established, one of the members of the verification team shall be appointed as lead verifier.

8.3.1 Minimum requirements for verifier(s)

The assessment of the competences of verifier/verification team is based on a scoring system that takes into account (i) verification and validation experience, (ii) EF/LCA methodology and practice, and (iii) knowledge of relevant technologies, processes or other activities included in the product(s)/organization(s) in scope of the study. Table 35 presents the scoring system for each relevant competence and experience topic.

Unless otherwise specified in the context of the intended application, the verifier's self-based declaration on the scoring system constitutes the minimum requirement. Verifier(s) shall provide a self-declaration of their qualifications (e.g. university diploma, working experience, certifications, etc.), stating how many points they achieved for each criterion and the total points achieved. This self-declaration shall form part of the EF verification report.

A verification of an EF study shall be conducted as per the requirements of the intended application. Unless otherwise specified, the minimum necessary score to qualify as a verifier or a verification team is six points, including at least one point for each of the three mandatory criteria (i.e. verification and validation practice, EF/LCA methodology and practice, and knowledge of technologies or other activities relevant to the EF study).

Table 35. Scoring system for each relevant competence and experience topic for the assessment of the competences of verifier(s)

			Score (points)				
	Topic	**Criteria**	**0**	**1**	**2**	**3**	**4**
Mandatory criteria	Verification and validation practice	Years of experience (1)	<2	2 ≤ x < 4	4 ≤ x < 8	8≤ x < 14	≥14
		Number of verifications (2)	≤5	5 < x ≤ 10	11 ≤ x ≤ 20	21 ≤ x ≤ 30	>30
	LCA methodology and practice	Years of experience (3)	<2	2 ≤ x < 4	4 ≤ x < 8	8≤ x < 14	≥14
		Number of LCA studies or reviews (4)	≤5	5 < x ≤ 10	11 ≤ x ≤ 20	21 ≤ x ≤ 30	>30
	Knowledge of the specific sector	Years of experience (5)	<1	1 ≤ x < 3	3 ≤ x < 6	6≤ x < 10	≥10

			Score (points)				
	Topic	**Criteria**	**0**	**1**	**2**	**3**	**4**
Additional criteria	Review, verification/validation practice	Optional scores relating to verification/validation	— 2 points: Accreditation as third party verifier for EMAS — 1 point: Accreditation as third party reviewer for at least one EPD Scheme, ISO 14001, or other EMS				

(1) Years of experience in the field of environmental verifications and/or review of LCA/PEF/EPD studies.

(2) Number of verifications for EMAS, ISO 14001, International EPD scheme or other EMS.

(3) Years of experience in the field of LCA modelling. Eventual work done during master and bachelor degrees shall be excluded. Work done during a relevant Ph.D./Doctorate course shall be accounted for. Experience in LCA modelling includes, among others:

- LCA modelling in commercial and non-commercial software
- Datasets and database development

(4) Studies compliant with one of the following standards/methods: PEF, OEF, ISO 14040-44, ISO 14067, ISO 14025

(5) Years of experience in a sector related to the studied product(s)/sector. The experience in the sector can be gained through LCA studies or through other types of activities. . The LCA studies shall be done on behalf of and with access to primary data of the producing/operating industry. 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 may also be used. Experience gained with technologies or processes in a whole sector are considered valid for any of its sub-sectors..

8.3.2 Role of the lead verifier in the verification team

The lead verifier is a team member with additional tasks. The lead verifier shall:

— distribute the tasks to be fulfilled between the team members according to the specific competencies of the team members, in order to get the full coverage of the tasks to be done and to use in the best manner the specific competencies of the team members;

— coordinate the whole verification/validation process and ensure that all team members have a common understanding of the tasks they need to fulfil;

— assemble all comments and ensure they are communicated to the commissioner of the EF study in a clear and comprehensible way;

— resolve any conflicting statements between team members;

— ensure that the verification report and validation statement are generated and are signed by each member of the verification team.

8.4 Verification/validation requirements

The verifier(s) shall describe all the outcomes related to the verification of the EF study, EF report and EF communication vehicles and give the commissioner of the EF study the opportunity to improve the work, if necessary. Depending on the nature of the outcomes, additional iterations of comments and responses may be necessary. Any changes made in response to the verification outcomes shall be documented in the verification report.

The verification/validation shall be done as a combined documental review and a model validation.

- the documental review includes the EF report, the technical content of any communication vehicle, and the data used in the calculations (through requested underlying documents). Verifier(s) may organise the documental review either as an “on desk” or “on site” exercise,

or as a mix of the two. The verification of the company-specific data shall always be organised through a visit of the production site(s) the data refer to.

- the validation of the model may take place at the production site of the commissioner of the study or be organised remotely. The verifier(s) shall access the model in order to verify its structure, the data used, and its consistency with the EF report. The details about how the verifier(s) accesses the model shall be agreed by the commissioner of the EF study and the verifier(s).

The verification may take place at the end of the EF study or in parallel (concurrent) to the study.

8.4.1 Requirements for the verification/validation when an OEFSR is available

The verifier(s) shall verify that the EF report, EF communication (if any) and EF study is in compliance with the following standards/guidance documents:

a) most recent version of OEFSR applicable for the specific product/sector in scope.
b) conformance with the latest official version of the EF method;
c) conformance with the ISO 14040 series of standards, for any requirement not covered in the OEF method or in the OEFSR guidance. In case of conflicting requirements, the EF ones prevail;
d) conformance with the ISO 14020 series of standard for communication vehicles, if applicable.

Moreover, the verifier(s) shall ensure that data verification/validation includes:

e) coverage, precision, completeness, representativeness, consistency, reproducibility, sources and uncertainty;
f) plausibility, quality and accuracy of the LCA-based data;
g) quality and accuracy of additional environmental information;
h) quality and accuracy of the supporting information.

The validation of the EF report and EF communication shall be carried out by checking enough information to provide reasonable assurance that the EF report and communication fulfils all the conditions listed in section 8.4.1.1.

The verification and validation of the EF study shall be carried out by following the minimum requirements listed below and the additional OEFSR-specific requirements specified by the TS and documented in the OEFSR section "Verification".

8.4.1.1 Minimum requirements for the verification and validation of the EF study

The verifier(s) shall validate the accuracy and reliability of the quantitative information used in the calculation of the study. As this may be highly resource intensive, the following requirements shall be followed:

- the verifier shall check if the correct version of all impact assessment methods was used. For each of the most relevant impact categories, at least 50% of the characterisation factors (for

each of the most relevant EF impact categories) shall be verified, while all normalisation and weighting factors of all ICs shall be verified. In particular, the verifier shall check that the characterisation factors correspond to those included in the EF impact assessment method the study declares compliance with[80];

- all the newly created datasets shall be checked on their EF compliancy (for the meaning of EF compliant datasets refer to Annex I of the Guidance). All their underlying data (elementary flows, activity data and sub processes) shall be validated. The aggregated EF-compliant dataset of the product in scope (meaning, the EF study) is available on the EF node (http://eplca.jrc.ec.europa.eu/EF-node/);
- for at least 70% of the most relevant processes in situation 2 option 2 of the DNM, 70% of the underlying data shall be validated. The 70% data shall including all energy and transport sub processes for those in situation 2 option 2;
- for at least 60% of the most relevant processes in situation 3 of the DNM, 60% of the underlying data shall be validated;
- for at least 50% of the other processes in situation 1, 2 and 3 of the DNM, 50% of the underlying data shall be validated.

The selection of the processes to be validated for each situation shall be done ordering them from the most contributing to the less contributing one and selecting those contributing up to the identified percentage starting from the most contributing ones. In case of non-integer numbers, the rounding shall be made always considering the next upper integer.

For all processes to be validated, it shall be checked if the DQR satisfies the minimum DQR as specified in the OEFSR.

These data checks shall include, but should not be limited to, the activity data used, the selection of secondary sub-processes, the selection of the direct elementary flows and the CFF parameters. For example, if there are 5 processes and each one of them includes 5 activity data, 5 secondary datasets and 10 CFF parameters, then the verifier(s) has to check at least 4 out of 5 processes (70%) and, for each process, (s)he shall check at least 4 activity data (70% of the total amount of activity data), 4 secondary datasets (70% of the total amount of secondary datasets), and 7 CFF parameters (70% of the total amount of CFF parameters), i.e. the 70% of each of data that could be possible subject of check.

8.4.1.2 Additional requirements for the validation of the EF study

The OEFSR may specify additional requirements for the validation that should be added to the minimum requirements stated in this document. The verifier(s) shall check that all the minimum and additional requirements are satisfied during the verification process.

[80] Available at: http://eplca.jrc.ec.europa.eu/LCDN/developer.xhtml

8.4.2 Requirements for the verification and validation where no OEFSR is available

During the transition phase or until a European policy regulating EF-based information is adopted by the Commission, it is not recommended to carry out any communication of the environmental profile of a product or organisation in absence of a valid OEFSR[81].

In any case, if and when such a study is carried out, it shall be subject to an independent third party review carried out in accordance to ISO 14044, ISO 14071 and all complementary requirements included in this Guidance with reference to review of OEFSRs.

8.4.3 Verification and Validation techniques

The verifier shall assess and confirm whether the calculation methodologies applied are of acceptable accuracy, reliable, are appropriate and performed in accordance to these guidelines. The verifier shall confirm the correct application of conversion of measurement units.
The verifier shall check if applied sampling procedures are in accordance with the sampling procedure defined in the guidance document and OEFSR if available. The data reported shall be checked against the source documentation in order to check their consistency.
The verifiers shall evaluate whether the methods for making estimates are appropriate and have been applied consistently.
The verifier may assess alternatives to estimations or choices made, in the assertion to determine whether a conservative choice has been selected.
The verifier may identify uncertainties that are greater than expected and assess the effect of the identified uncertainty on the final EF results.

8.4.4 Data confidentiality

Data for validation shall be presented in a systematic and comprehensive way, all the project documentation supporting the validation of an EF study shall be provided to the verifier(s), including the EF model, the confidential information and data. This data and information shall be treated as confidential and shall be used only during the verification process.

Confidential information may be excluded from the report, provided that:

- the request for non-disclosure only cover input-information, not any output information;
- the commissioner of the EF study provides the verifier with sufficient information of the nature of the data and information, and the reason for the request of excluding the data or information from the study report;
- the verifier accept the non-disclosure and include in the verification report the reasons for doing so;

[81] An OEFSR is considered valid if it is included in the list available on DG ENV website at http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm (this page will be available once the final OEFSRs are delivered)

- the commissioner of the EF study keep a file of the non-disclosed information for possible future re-evaluation of the decision of non-disclosure.

Business data could be of confidential nature because of competitive business aspects, intellectual property rights or similar legal restrictions. Therefore, business data identified as confidential and provided during validation process shall be kept confidential. Hence, verifiers shall not disseminate or otherwise retain for use, without the permission of the organisation, any information disclosed to them during the course of the review work. The Commissioner of the EF study may ask to the verifier(s) to sign a Non-Disclosure Agreement (NDA).

8.5 Outputs of the verification/validation process

8.5.1 Content of the verification and validation report

The verification and validation report shall include all findings of the verification/validation process, the actions taken from the commissioner in order to answer to the comments of the verifier(s), and the final conclusion. The report is mandatory, but may be confidential.

The final conclusion may be of different nature:

- "compliant" if the documental or onsite information proves that the requirements of this chapter are fulfilled.
- "not compliant" if the documental or onsite information proves that the requirements of this chapter are not fulfilled.
- "complementary information needed" if the documental or onsite information cannot allow the verifier to conclude on the compliancy. It may happen if the information is not transparently or sufficiently documented or registered.

8.5.2 Content of the validation statement

The validation statement is mandatory and shall always be provided as annex of the public EF report. As a consequence, from each communication vehicles it shall be possible to have access to the complete public EF report, including the validation statement.

The following elements and aspects shall be included in the validation statement as a minimum:

— title of the EF study under verification/validation, together with the exact version of the report to which the validation statement belongs;
— the commissioner of the EF study;
— the practitioner of the EF study;
— the verifier(s) or, in the case of a verification team, the team members with the identification of the lead verifier;
— absence of conflicts of interest of the verifier(s) with respect to concerned products/sector and any involvement in previous work (OEFSR development,

Technical Secretariat membership, consultancy work carried out for the applicant during the last three years);

- a description of the objective of the verification/validation;
- a statement of the result of the verification/validation;
- Any limitations of the verification/validation outcomes;
- date in which the validation statement has been issued;
- signature by the verifier(s).

8.5.3 Validity of the verification and validation report and the validation statement

A verification and validation report and a validation statement shall refer only to one specific EF report. The verification and validation report and a validation statement shall unambiguously identify the specific EF study under verification (e.g. by including the title, the commissioner of the EF study, the practitioner of the EF study, etc.), together with the explicit version of the final EF report to which the verification and validation report and a validation statement apply (e.g. by including the report date, the version number, etc.).

Both the verification and validation report and the validation statement shall be completed on the basis of the final EF report, after the implementation of all the corrective actions requested by the verifier(s). They shall be signed, physically or electronically, by the verifier(s).

The maximum validity of the verification and validation report and of the validation statement shall not exceed three years starting from their first issue date.

During the validity period of the verification, surveillance follow up shall be agreed between the commissioner of the EF study and the verifier(s) in order to evaluate if the content is still consistent with the current situation (the suggested periodicity for this follow up is once per year).

The periodic checks shall focus on the parameters that according to the verifiers might lead to relevant changes in the results of the EF study. A non-exhaustive list of such parameters is:

- bill of material/ bill of components;
- energy mix used for processes in situation 1;
- change of packaging;
- changes in the suppliers (materials/geography);
- changes in the logistics;
- relevant technological changes in the processes in situation 1.

At the time of the periodic check the reasons for non-disclosure of information should also be reconsidered. The surveillance verification may be organised as a documental check and/or through on-site inspections.

Regardless of the validity, the EF study (and consequently the EF report) shall be updated during the surveillance period if one of the impact categories indicators communicated has worsened by more than 10.0% compared with the verified data, or if the total aggregated score has worsened by more than 5.0% compared with the verified data.

If these changes impact also in the communication content, they shall be updated accordingly.

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9 References

ANIA and ADEME. (2012). Projet de référentiel transversal d'évaluation de l'impact environnemental des produits alimentaires (mainly annexe 4) (« GT1 »), 23/04/12.

Årsrapport (2013). Dansk retursystem.

Beck, T., Bos, U., Wittstock, B., Baitz, M., Fischer, M., Sedlbauer, K. (2010). 'LANCA Land Use Indicator Value Calculation in Life Cycle Assessment – Method Report', Fraunhofer Institute for Building Physics.

Bos U., Horn R., Beck T., Lindner J.P., Fischer M. (2016). LANCA® - Characterisation Factors for Life Cycle Impact Assessment, Version 2.0, 978-3-8396-0953-8Fraunhofer Verlag, Stuttgart.

Boucher, O., P. Friedlingstein, B. Collins, and K. P. Shine, (2009). The indirect global warming potential and global temperature change potential due to methane oxidation. Environ. Res. Lett., 4, 044007.

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

BSI (2012). PAS 2050-1:2012. Assessment of life cycle greenhouse gas emissions from horticultural products - Supplementary requirements for the cradle to gate stages of GHG assessments of horticultural products undertaken in accordance with PAS 2050. London, British Standards Institution.

CEPI (2008). European Recovered Paper Identification System.

Decision 529/2013/EU. European Parliament and the Council: "Decision No 529/2013/EU of the European Parliament and of the Council of 21 May 2013 on accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry and on information concerning actions relating to those activities." Official Journal of the European Union: L 165/180 - 197.

Deloitte (2014). Trippage rates and transportation distances in the beverage industry. Commissioned by the Federation of German Food and Drink Industries and the Association of German Retailers.

Dreicer, M., Tort, V., Manen, P. (1995). ExternE, Externalities of Energy, Vol. 5 Nuclear, Centr d'étude sur l'Evaluation de la Protection dans le domaine nucléaire (CEPN), edited by the European Commission DGXII, Science, Research and development JOULE, Luxembourg.

EC-JRC, (2017a). Environmental footprint characterisation factors. Available at http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml

EC-JRC, (2017b). Life cycle impact assessment methods and characterisation factors for Environmental Footprint. Technical details on the characterisation factors implementation. JRC technical report, forthcoming

4135 EN standard (2007). 15343:2007: Plastics — Recycled Plastics — Plastics recycling traceability and
4136 assessment of conformity and recycled content.

4137 European Commission - Joint Research Centre - Institute for Environment and Sustainability (2010-
4138 2016). "International Reference Life Cycle Data System (ILCD) handbook." Retrieved 17 Oct 2016,
4139 2016, from http://eplca.jrc.ec.europa.eu/?page_id=140. ILCD

4140 European Commission (2012). Regulation no 1179/2012: Establishing criteria determining when
4141 glass cullet ceases to be waste under Directive 2008/98/EC of the European Parliament and of the
4142 Council.

4143 European Commission (2013). "Annex II: Product Environmental Footprint (PEF) Guide in
4144 Commission Recommendation of 9 April 2013 on the use of common methods to measure and
4145 communicate the life cycle environmental performance of products and organisations
4146 (2013/179/EU)." Official Journal of the European Union 56(L 124): 6-106.

4147 Fantke, P., Evans, J., Hodas, N., Apte, J., Jantunen, M., Jolliet, O., McKone, T.E. (2016). Health impacts
4148 of fine particulate matter. In: Frischknecht, R., Jolliet, O. (Eds.), Global Guidance for Life Cycle Impact
4149 Assessment Indicators: Volume 1. UNEP/SETAC Life Cycle Initiative, Paris, pp. 76-99. Retrieved Jan
4150 2017 from www.lifecycleinitiative.org/applying-lca/lcia-cf/.

4151 Frischknecht, R., Braunschweig, A., Hofstetter P., Suter P. (2000), Modelling human health effects of
4152 radioactive releases in Life Cycle Impact Assessment. Environmental Impact Assessment Review, 20
4153 (2) pp. 159-189.

4154 Guinée, J.B. (Ed.), Gorrée, M., Heijungs, R., Huppes, G., Kleijn, R., de Koning, A., Van Oers, L.,
4155 Wegener Sleeswijk, A., Suh, S.,. Udo de Haes, H.A, De Bruijn, J.A., Van Duin R., Huijbregts, M.A.J.
4156 (2002). Handbook on Life Cycle Assessment: Operational Guide to the ISO Standards. Series: Eco-
4157 efficiency in industry and science. Kluwer Academic Publishers. Dordrecht (Hardbound, ISBN 1-4020-
4158 0228-9; Paperback, ISBN 1-4020-0557-1).

4159 IPCC (2013). IPCC Climate Change Fifth Assessment Report: Climate Change 2013.
4160 http://www.ipcc.ch/ipccreports/assessments-reports.htm

4161 IPCC (2006). Guidelines for National Greenhouse Gas Inventories.

4162 IPCC (2007). Forster, P., V. Ramaswamy, P. Artaxo, T. Berntsen, R. Betts, D.W. Fahey, J. Haywood, J.
4163 Lean, D.C. Lowe, G. Myhre, J. Nganga, R. Prinn,G. Raga, M. Schulz and R. Van Dorland, 2007: Changes
4164 in Atmospheric Constituents and in Radiative Forcing. In: Climate Change 2007: The Physical Science
4165 Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental
4166 Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt,
4167 M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New
4168 York, NY, USA.

4169 IPCC (2013). Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F.
4170 Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang,
4171 2013: Anthropogenic and Natural Radiative Forc-ing. In: Climate Change 2013: The Physical Science

4172 Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental
4173 Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A.
4174 Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United
4175 Kingdom and New York, NY, USA.

4176 Nederlands Instituut voor Bouwbiologie en Ecologie (2014). Vergelijkend LCA onderzoek houten en
4177 kunststof pallets.

4178 Palandre et al. (2003). Estimation of the world-wide fleets of refrigerating and air-conditioning
4179 equipment in order to determine forecasts of refrigerant emissions.

4180 PERIFEM and ADEME “Guide sectorial 2014: Réalisation d’un bilan des emissions de gaz à effet de
4181 serre pour distribution et commerce de detail”.

4182 Posch, M., Seppälä, J., Hettelingh, J.P., Johansson, M., Margni M., Jolliet, O. (2008). The role of
4183 atmospheric dispersion models and ecosystem sensitivity in the determination of characterisation
4184 factors for acidifying and eutrophying emissions in LCIA. International Journal of Life Cycle
4185 Assessment (13) pp.477–486

4186 Rosenbaum, R.K., Anton, A., Bengoa, X. et al. 2015. The Glasgow consensus on the delineation
4187 between pesticide emission inventory and impact assessment for LCA. International Journal of Life
4188 Cycle Assessment, 20: 765).

4189 Rosenbaum, R.K., Bachmann, T.M., Gold, L.S., Huijbregts, M.A.J., Jolliet, O., Juraske, R., Köhler, A.,
4190 Larsen, H.F., MacLeod, M., Margni, M., McKone, T.E., Payet, J., Schuhmacher, M., van de Meent, D.,
4191 Hauschild, M.Z. (2008): USEtox - The UNEPSETAC toxicity model: recommended characterisation
4192 factors for human toxicity and freshwater ecotoxicity in Life Cycle Impact Assessment. International
4193 Journal of Life Cycle Assessment, 13(7): 532-546, 2008

4194 Seppälä, J., Posch, M., Johansson, M., Hettelingh, J.P. (2006). Country-dependent Characterisation
4195 Factors for Acidification and Terrestrial Eutrophication Based on Accumulated Exceedance as an
4196 Impact Category Indicator. International Journal of Life Cycle Assessment 11(6): 403-416

4197 Struijs, J., Beusen, A., van Jaarsveld, H. and Huijbregts, M.A.J. (2009). Aquatic Eutrophication.
4198 Chapter 6 in: Goedkoop, M., Heijungs, R., Huijbregts, M.A.J., De Schryver, A., Struijs, J., Van Zelm, R.
4199 (2009). ReCiPe 2008 A life cycle impact assessment method which comprises harmonised category
4200 indicators at the midpoint and the endpoint level. Report I: Characterisation factors, first edition.

4201 Tassou, S.A., De-Lille, G., and Ge, Y.T. (2009). Food transport refrigeration – Approaches to reduce
4202 energy consumption and environmental impacts of road transport. Applied Thermal Engineering, 29,
4203 1467-1477.

4204 UNEP (2016) Global guidance for life cycle impact assessment indicators. Volume 1. ISBN: 978-92-
4205 807-3630-4. Available at: http://www.lifecycleinitiative.org/life-cycle-impact-assessment-indicators-
4206 and-characterization-factors/

van Oers L, de Koning A, Guinee JB, Huppes G (2002). Abiotic Resource Depletion in LCA. Road and Hydraulic Engineering Institute, Ministry of Transport and Water, Amsterdam

Van Zelm, R., Huijbregts, M.A.J., Den Hollander, H.A., Van Jaarsveld, H.A., Sauter, F.J., Struijs, J., Van Wijnen, H.J., Van de Meent, D. (2008). European characterizationfactors for human health damage of PM10 and ozone in life cycle impact assessment. Atmospheric Environment 42, 441-453

WMO (1999). Scientific Assessment of Ozone Depletion: 1998. Global Ozone Research and Monitoring Project - Report No. 44, ISBN 92-807-1722-7, Geneva

Annex A - List of EF impact categories, normalisation and weighting factors

List of recommended models at midpoint, together with their indicator, unit and source. In red text: the differences compared to the OEF guide (2013)

Recommendation at midpoint					
Impact category	**Indicator**	**Unit**	**Recommended default LCIA method**	**Source of CFs**	**Robustness**
Climate change[82]	Radiative forcing as Global Warming Potential (GWP100)	kg $CO_{2\ eq}$	Baseline model of 100 years of the IPCC (based on IPCC 2013)	EC-JRC, 2017[83]	I
Ozone depletion	Ozone Depletion Potential (ODP)	kg CFC-11 $_{eq}$	Steady-state ODPs as in (WMO 1999)	EC-JRC, 2017	I
Human toxicity, cancer*	Comparative Toxic Unit for humans (CTU_h)	CTUh	USEtox model (Rosenbaum et al, 2008)	EC-JRC, 2017	III/interim
Human toxicity, non- cancer*	Comparative Toxic Unit for humans (CTU_h)	CTUh	USEtox model (Rosenbaum et al, 2008)	EC-JRC, 2017	III/interim
Particulate matter	Impact on human health	Disease incidence	PM method recommended by UNEP (UNEP 2016)	EC-JRC, 2017	I
Ionising radiation, human health	Human exposure efficiency relative to U^{235}	kBq U^{235} $_{eq}$	Human health effect model as developed by Dreicer et al. 1995 (Frischknecht et al, 2000)	EC-JRC, 2017	II
Photochemical ozone formation, human health	Tropospheric ozone concentration increase	kg NMVOC $_{eq}$	LOTOS-EUROS (Van Zelm et al, 2008) as implemented in ReCiPe 2008	EC-JRC, 2017	II
Acidification	Accumulated Exceedance (AE)	mol H+ $_{eq}$	Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)	EC-JRC, 2017	II
Eutrophication, terrestrial	Accumulated Exceedance (AE)	mol N $_{eq}$	Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)	EC-JRC, 2017	II

[82] Three additional sub-indicators may be requested for reporting, depending on the OEFSR. The sub-indicators are further described in section 7.9.

[83] The full list of characterization factors (EC-JRC, 2017a) is available at this link http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml

Recommendation at midpoint					
Impact category	**Indicator**	**Unit**	**Recommended default LCIA method**	**Source of CFs**	**Robustness**
Eutrophication, freshwater	Fraction of nutrients reaching freshwater end compartment (P)	kg P $_{eq}$	EUTREND model (Struijs et al, 2009) as implemented in ReCiPe	EC-JRC, 2017	II
Eutrophication, marine	Fraction of nutrients reaching marine end compartment (N)	kg N $_{eq}$	EUTREND model (Struijs et al, 2009) as implemented in ReCiPe	EC-JRC, 2017	II
Ecotoxicity, freshwater*	Comparative Toxic Unit for ecosystems (CTU_e)	CTUe	USEtox model, (Rosenbaum et al, 2008)	EC-JRC, 2017	III/interim
Land use	• Soil quality index[84] • Biotic production • Erosion resistance • Mechanical filtration • Groundwater replenishment	• dimensionless (pt) • kg biotic production • kg soil • m^3 water • m3 groundwater	Soil quality index based on LANCA (Beck et al. 2010 and Bos et al. 2016)	EC-JRC, 2017	III
Water use[#]	User deprivation potential (deprivation-weighted water consumption)	m^3 world $_{eq}$	Available WAter REmaining (AWARE) as recommended by UNEP, 2016	EC-JRC, 2017	III
Resource use, minerals and metals	Abiotic resource depletion (ADP ultimate reserves)	kg Sb $_{eq}$	CML 2002 (Guinée et al., 2002) and van Oers et al. 2002.		III
Resource use, fossils	Abiotic resource depletion – fossil fuels (ADP-fossil)[85]	MJ	CML 2002 (Guinée et al., 2002) and van Oers et al. 2002	EC-JRC, 2017	III

* Long-term emissions (occurring beyond 100 years) are excluded from the toxic impact categories. Toxicity emissions to this sub-compartment have a characterisation factor set to 0 in the EF LCIA (to ensure consistency). If included by the applicant in the LCI modelling, the sub-compartment 'unspecified (long-term)' shall be used.

[#]The results for water use might be overestimated and shall therefore be interpreted with caution. Some of the EF datasets tendered during the pilot phase and used in this PEFCR/OEFSR include inconsistencies in the regionalization and elementary flow implementations. This problem has nothing to do with the impact assessment method or the implementability of EF methods, but occurred during the technical development of some of the datasets. The PEFCR/OEFSR remains valid and usable. The affected EF datasets will be corrected by mid-2019. At that time it will be possible to review this PEFCR/OEFSR accordingly, if seen necessary.

The full list of characterization factors (EC-JRC, 2017a) is available at this link http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml

[84] This index is the result of the aggregation, performed by JRC, of the 4 indicators provided by LANCA model as indicators for land use

[85] In the ILCD flow list, and for the current recommendation, Uranium is included in the list of energy carriers, and it is measured in MJ.

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Global normalisation factors for Environmental Footprint

Impact category	Model	Unit	global NFs for PEF	Person NF for PEF	Robustness of ILCD for the PEF impact assessment	Inventory coverage completeness	Inventory robustness	Comment
Climate change	IPCC, 2013	kg $CO_{2\ eq}$	5.35E+13	7.76E+03	I	II	I	
Ozone depletion	World Metereological Organisation (WMO), 1999	kg CFC-11 $_{eq}$	1.61E+08	2.34E-02	I	III	II	
Human toxicity, cancer	USEtox (Rosenbaum et al., 2008)	CTUh	2.66E+05	3.85E-05	II/III	III	III	
Human toxicity, non-cancer	USEtox (Rosenbaum et al., 2008)	CTUh	3.27E+06	4.75E-04	II/III	III	III	
Particulate matter	UNEP, 2016	disease incidence	4.39E+06	6.37E-04	I	I/II	I /II	NF calculation takes into account the emission height both in the emission inventory and in the impact assessment.
Ionising radiation, human health	Frischknecht et al., 2000	kBq U^{235} $_{eq}$	2.91E+13	4.22E+03	II	II	III	
Photochemical ozone formation, human health	Van Zelm et al., 2008, as applied in ReCiPe, 2008	kg NMVOC $_{eq}$	2.80E+11	4.06E+01	II	III	I/II	
Acidification	Posch et al., 2008	mol H+ $_{eq}$	3.83E+11	5.55E+01	II	II	I/II	

Eutrophication, terrestrial	Posch et al., 2008	mol N $_{eq}$	1.22E +12	1.77E +02	II	II	I/II	
Eutrophication, freshwater	Struijs et al., 2009	kg P $_{eq}$	1.76E +10	2.55E +00	II	II	III	
Eutrophication, marine	Struijs et al., 2009	kg N $_{eq}$	1.95E +11	2.83E +01	II	II	II/III	
Ecotoxicity freshwater	USEtox (Rosenbaum et al., 2008)	CTUe	8.15+13	1.18E +04	II/III	III	III	
Land use	Bos et al., 2016 (based on)	pt	9.2E+15	1.33E +06	III	II	I I	The NF is built by means of regionalised CFs.
Water use	AWARE 100 (based on; UNEP, 2016)	m^3 world $_{eq}$	7.91E +13	1.15E +04	III	I	II	The NF is built by means of regionalised CFs.
Resource use, fossils	ADP fossils (van Oers et al., 2002)	MJ	4.50E +14	6.53E +04	III	I	II	
Resource use, minerals and metals	ADP ultimate reserve (van Oers et al., 2002)	kg Sb $_{eq}$	3.99E +08	5.79E-02	III			

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Weighting factors for Environmental Footprint

	Aggregated weighting set	Robustness factors	Calculation	**Final weighting factors**
WITH TOX CATEGORIES (not applied in the pilot phase)	(50:50)	(scale 1-0.1)		
	A	B	C=A*B	C scaled to 100
Climate change	12.9	0.87	11.18	**21.06**
Ozone depletion	5.58	0.6	3.35	**6.31**
Human toxicity, cancer	6.8	0.17	1.13	**2.13**
Human toxicity, non-cancer	5.88	0.17	0.98	**1.84**

Particulate matter	5.49	0.87	4.76	**8.96**
Ionizing radiation, human health	5.7	0.47	2.66	**5.01**
Photochemical ozone formation, human health	4.76	0.53	2.54	**4.78**
Acidification	4.94	0.67	3.29	**6.2**
Eutrophication, terrestrial	2.95	0.67	1.97	**3.71**
Eutrophication, freshwater	3.19	0.47	1.49	**2.8**
Eutrophication, marine	2.94	0.53	1.57	**2.96**
Ecotoxicity, freshwater	6.12	0.17	1.02	**1.92**
Land use	9.04	0.47	4.22	**7.94**
Water use	9.69	0.47	4.52	**8.51**
Resource use, minerals and metals	6.68	0.6	4.01	**7.55**
Resource use, fossils	7.37	0.6	4.42	**8.32**

	Aggregated weighting set	Robustness factors	Calculation	**Final weighting factors**
WITHOUT TOX CATEGORIES (applied in the pilot phase)	(50:50)	(scale 1-0.1)		
	A	B	C=A*B	C scaled to 100
Climate change	15.75	0.87	13.65	**22.19**
Ozone depletion	6.92	0.6	4.15	**6.75**
Particulate matter	6.77	0.87	5.87	**9.54**
Ionizing radiation, human health	7.07	0.47	3.3	**5.37**
Photochemical ozone formation, human health	5.88	0.53	3.14	**5.1**
Acidification	6.13	0.67	4.08	**6.64**
Eutrophication, terrestrial	3.61	0.67	2.4	**3.91**
Eutrophication, freshwater	3.88	0.47	1.81	**2.95**
Eutrophication, marine	3.59	0.53	1.92	**3.12**
Land use	11.1	0.47	5.18	**8.42**
Water use	11.89	0.47	5.55	**9.03**
Resource use, minerals and metals	8.28	0.6	4.97	**8.08**
Resource use, fossils	9.14	0.6	5.48	**8.92**

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Annex B - OEFSR template

Note: the text included in italics in each section shall not be modified when drafting the OEFSR, except for references to tables, figures and equations. References shall be revised and linked correctly. Further text may be added if relevant.

The text included in [] are instructions for the OEFSR developers.

The order of sections and their titles shall not be modified.

The first page shall include at least the following information:

- The sector for which the OEFSR is valid
- Version number
- Date of publication
- Time validity (31st December 2020)]

Table of contents

[Enter table of contents]

Acronyms

[List in this section all the acronyms used in the OEFSR. Those already included in the latest version of the OEF guide or the OEFSR Guidance shall be copied in their original form. The acronyms shall be provided in alphabetical order.]

Definitions

[List in this section all the definitions that are relevant for the OEFSR. Those already included in the latest version of the OEF Guide or the OEFSR Guidance shall be copied in their original form. The definitions shall be provided in alphabetical order.]

B.1 Introduction

The Organisation Environmental Footprint (OEF) Guide provides detailed and comprehensive technical guidance on how to conduct an OEF study. OEF studies may be used for a variety of purposes, including in-house management and participation in voluntary or mandatory programmes.

For all requirements not specified in this OEFSR the applicant shall refer to the documents this OEFSR is in conformance with (see chapter B.2.7).

The compliance with the present OEFSR is optional for OEF in-house applications, whilst it is mandatory whenever the results of an OEF study or any of its content is intended to be communicated.

Terminology: shall, should and may

This OEFSR uses precise terminology to indicate the requirements, the recommendations and options that could be chosen when an OEF study is conducted.

- *The term "shall" is used to indicate what is required in order for an OEF study to be in conformance with this OEFSR.*
- *The term "should" is used to indicate a recommendation rather than a requirement. Any deviation from a "should" requirement has to be justified when developing the OEF study and made transparent.*
- *The term "may" is used to indicate an option that is permissible. Whenever options are available, the OEF study shall include adequate argumentation to justify the chosen option.*

B.2 General information about the OEFSR

B.2.1 Technical secretariat

[The list of the organizations in the TS at the time of final vote shall be provided. For each one, the type of organization shall be reported (industry, academia, NGO, consultant, etc.), as well as the starting date of participation. The TS may decide to include also the names of the members of the persons involved for each organization]

Name of the organization	*Type of organization*	*Name of the members (not mandatory)*

B.2.2 Consultations and stakeholders

[For each public consultation the following information shall be provided:

- Opening and closing date of the public consultation
- Number of comments received
- Names of organizations that have provided comments
- The link to the wiki page]

B.2.3 Review panel and review requirements of the OEFSR

[This section shall include the names and affiliations of the members of the review panel. The member that is chairing the review panel shall be identified.]

Name of the member	*Affiliation*	*Role*

The reviewers have verified that the following requirements have been fulfilled:

- *The OEFSR has been developed in accordance with the requirement provided in the OEFSR Guidance* [indicate the version the OEFSR is in conformance with]*, and where appropriate in accordance with the requirements provided in the most recent approved version of the OEF Guide, and supports creation of credible and consistent OEF profiles,*
- *Functional unit, allocation and calculation rules are adequate for the sector under consideration,*
- *Company-specific and secondary datasets used to develop this OEFSR are relevant, representative, and reliable,*
- *The selected LCIA indicators and additional environmental information are appropriate for the sector under consideration and the selection is done in accordance with the guidelines stated in the OEFSR Guidance version* [indicate the version the OEFSR is in conformance with] *and the most recent approved version of the OEF Guide, and*
- *Both LCA-based data and the additional environmental information prescribed by the OEFSR give a description of the significant environmental aspects associated with the sector.*

[The TS may add additional review criteria as appropriate]

The detailed review report is provided in Annex 3 of this OEFSR.

B.2.4 Review statement

This OEFSR has been developed in compliance with Version [indicate the version the OEFSR is in conformance with] *of the OEFSR Guidance, and with the OEF Guide adopted by the Commission on* [indicate the date of approval of the latest version available].

The representative product portfolio correctly describes the average sector in scope of this OEFSR.

OEF studies carried out in compliance with this OEFSR would reasonably lead to reproducible results and the information included therein may be used to make comparisons and comparative assertions under the prescribed conditions (see chapter on limitations).

[The review statement shall be completed by the reviewer.]

B.2.5 Geographic validity

This OEFSR is valid for the … [fill in region].

Each OEF study shall identify its geographical validity listing all the countries where the organisation's activities take place, together with the relative market share.

B.2.6 Language

The OEFSR is written in English. The original in English supersedes translated versions in case of conflicts.

B.2.7 Conformance to other documents

This OEFSR has been prepared in conformance with the following documents (in prevailing order):

- *OEFSR Guidance* - [add the version of the Guidance the OEFSR is in conformance with]*"*
- *Organisation Environmental Footprint (OEF) Guide; Annex III to the Recommendation 2013/179/EU, 9 April 2013. Published in the official journal of the European Union Volume 56, 4 May 2013*

[The OEFSR shall list additional documents, if any, with which the OEFSR is in conformance with.]

B.3 OEFSR scope

[This section shall include a description of the scope of the OEFSR and shall clearly list the number of sub-categories (if any) included in the scope of the OEFSR]

B.3.1 The sector

[The OEFSR shall include a sector definition.]

The NACE codes for the sectors included in this OEFSR are: …

[Based on the sector category, provide the corresponding statistical classification of economic activities in the European community, NACE (minimum two-digit, based on the latest NACE version available). Identify the sub-categories not covered by the NACE, if any]

B.3.2 Representative organisation(s)

[The OEFSR shall include a description of the representative/virtual organisation(s) and how it has been derived.]

The screening study is available upon request to the TS coordinator that has the responsibility of distributing it with an adequate disclaimer about its limitations.

B.3.3 Reporting unit and product portfolio

The reporting unit is … [to be filled in].

[The OEFSR shall specify the product portfolio (PP; as reference flow) and how the PP is defined, in particular with respect to “how well” and “how long”. It shall also define the reporting interval when this differs from one year, and justify the chosen interval. It shall describe how the appropriate reference flow shall be determined/calculated. In case calculation parameters are needed, the OEFSR shall provide default values or shall request these parameters in the list of mandatory company-specific information. A calculation example shall be provided.]

B.3.4 System boundary

[This section shall include a system diagram clearly indicating the processes and life cycle stages included in the Organisational boundary and OEF boundary. It shall also specify what is excluded and give justification if downstream (indirect) activities are excluded (e.g. use stage of intermediate products or products with an undeterminable fate). The diagram shall include an indication of the processes for which company-specific data are required.]

The following life cycle stages and processes shall be included in the system boundary:

Table B. 1. Life cycle stages

Life cycle stage	***Short description of the processes included***

According to this OEFSR, the following processes may be excluded based on the cut-off rule: [include the list of processes that shall be excluded based on the cut off rule] OR *According to this OEFSR, no cut-off is applicable*.

Each OEF study done in accordance with this OEFSR shall provide in the OEF report a diagram indicating the organizational boundary, to highlight those activities under the control of the organization and those falling into Situation 2 or 3 of the data need matrix.

All processes defined within the OEFSR boundaries shall be modelled by the applicant.

[The OEFSR shall request the applicant to define its organisation with reference to the PP through its name, kind of goods and services produced, location of operation, and NACE codes.]

B.3.5 EF Impact assessment

Each OEF study carried out in compliance with this OEFSR shall calculate the OEF-profile including all OEF impact categories listed in the table below. [The TS shall indicate in the table if the sub-categories for climate change shall be calculated separately.]

Table B. 2. List of 16 impact categories to be used to calculate the OEF profile

Impact category	***Indicator***	***Unit***	***Recommended default LCIA method***
Climate change	*Radiative forcing as Global Warming Potential (GWP100)*	*kg $CO_{2\ eq}$*	*Baseline model of 100 years of the IPCC (based on IPCC 2013)*
- Climate change-biogenic [strikethrough if not to be reported upon]			
- Climate change – land use and land transformation [strikethrough if not to be reported upon]			
Ozone depletion	*Ozone Depletion Potential (ODP)*	*kg CFC-11 $_{eq}$*	*Steady-state ODPs 1999 as in WMO assessment*
Human toxicity, cancer*	*Comparative Toxic Unit for humans (CTUh)*	*CTUh*	*USEtox model (Rosenbaum et al, 2008)*
Human toxicity, non- cancer*	*Comparative Toxic Unit for humans (CTUh)*	*CTUh*	*USEtox model (Rosenbaum et al, 2008)*
Particulate matter	*Impact on human health*	*disease incidence*	*UNEP recommended model (Fantke et al 2016)*
Ionising radiation, human health	*Human exposure efficiency relative to U235*	*kBq U^{235} $_{eq}$*	*Human health effect model as developed by Dreicer et al. 1995 (Frischknecht et al, 2000)*
Photochemical ozone formation, human health	*Tropospheric ozone concentration increase*	*kg NMVOC $_{eq}$*	*LOTOS-EUROS (Van Zelm et al, 2008) as implemented in ReCiPe*
Acidification	*Accumulated Exceedance (AE)*	*mol H+ $_{eq}$*	*Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)*
Eutrophication, terrestrial	*Accumulated Exceedance (AE)*	*mol N $_{eq}$*	*Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)*
Eutrophication, freshwater	*Fraction of nutrients reaching freshwater end compartment (P)*	*kg P $_{eq}$*	*EUTREND model (Struijs et al, 2009b) as implemented in ReCiPe*
Eutrophication, marine	*Fraction of nutrients reaching marine end compartment (N)*	*kg N $_{eq}$*	*EUTREND model (Struijs et al, 2009b) as implemented in ReCiPe*
Ecotoxicity, freshwater*	*Comparative Toxic Unit for ecosystems (CTUe)*	*CTUe*	*USEtox model, (Rosenbaum et al, 2008)*

Impact category	*Indicator*	*Unit*	*Recommended default LCIA method*
Land use	• *Soil quality index*[86] • *Biotic production* • *Erosion resistance* • *Mechanical filtration* • *Groundwater replenishment*	• *Dimensionless (pt)* • *kg biotic production*[87] • *kg soil* • *m^3 water* • *m^3 groundwater*	• *Soil quality index based on LANCA (EC-JRC)*[88] • *LANCA (Beck et al. 2010)* • *LANCA (Beck et al. 2010)* • *LANCA (Beck et al. 2010)* • *LANCA (Beck et al. 2010)*
Water use[#]	*User deprivation potential (deprivation-weighted water consumption)*	*m^3 world $_{eq}$*	*Available WAter REmaining (AWARE) Boulay et al., 2016*
Resource use, minerals and metals	*Abiotic resource depletion (ADP ultimate reserves)*	*kg Sb $_{eq}$*	*CML 2002 (Guinée et al., 2002) and van Oers et al. 2002.*
Resource use, fossils	*Abiotic resource depletion – fossil fuels (ADP-fossil)*	*MJ*	*CML 2002 (Guinée et al., 2002) and van Oers et al. 2002*

**Long-term emissions (occurring beyond 100 years) shall be excluded from the toxic impact categories. Toxicity emissions to this sub-compartment have a characterisation factor set to 0 in the EF LCIA (to ensure consistency). If included by the applicant in the LCI modelling, the sub-compartment 'unspecified (long-term)' shall be used.*

[#]The results for water use might be overestimated and shall therefore be interpreted with caution. Some of the EF datasets tendered during the pilot phase and used in this PEFCR/OEFSR include inconsistencies in the regionalization and elementary flow implementations. This problem has nothing to do with the impact assessment method or the implementability of EF methods, but occurred during the technical development of some of the datasets. The PEFCR/OEFSR remains valid and usable. The affected EF datasets will be corrected by mid-2019. At that time it will be possible to review this PEFCR/OEFSR accordingly, if seen necessary.

The full list of normalization factors and weighting factors are available in Annex 1 - List of EF normalisation factors and weighting factors.

The full list of characterization factors (EC-JRC, 2017a) is available at this link [*http://eplca.jrc.ec.europa.eu/LCDN/developer.xhtm*](http://eplca.jrc.ec.europa.eu/LCDN/developer.xhtm)

[86] This index is the result of the aggregation, performed by JRC, of the 4 indicators provided by LANCA model as indicators for land use

[87] This refers to occupation. In case of transformation the LANCA indicators are without the year (a)

[88] Forthcoming document on the update of the recommended Impact Assessment methods and factors for the EF

B.3.6 Limitations

[This section shall include the list of limitations an OEF study will have even if carried out in accordance with this OEFSR. It shall also include the conditions under which a comparison or comparative assertion may be made.]

B.4 Summary of most relevant impact categories, life cycle stages, and processes

The most relevant impact categories for the sector in scope of this OEFSR are the following:

- [list the most relevant impact categories per sub-category if appropriate. If climate change is selected as a relevant impact category, the OEFSR shall (i) always request to report the total climate change as the sum of the three sub-indicators, and (ii) for the sub-indicators 'Climate change - biogenic' and 'Climate change - land use and land transformation', request separate reporting for those contributing more than 5% each to the total score. A footnote shall be added, explaining why or why not the two sub-indicators shall be (i) or not be (ii) reported separately:]

(i)The sub-indicators 'Climate change - biogenic' and 'Climate change - land use and land transformation' shall be reported separately because their contribution to the total climate change impact, based on the benchmark results, is more than 5% each.

(ii)The sub-indicators 'Climate change - biogenic' and 'Climate change - land use and land transformation' shall not be reported separately because their contribution to the total climate change impact, based on the benchmark results, is less than 5% each.

The most relevant life cycle stages for the sector in scope of this OEFSR are the following:

- [list the most relevant life cycle stages per sub-category if appropriate.]

The most relevant processes for the sector in scope of this OEFSR are the following [this Table shall be filled in based on the final results of the representative organization(s). Provide one table per sub-category, if appropriate.]*:*

Table B. 3. List of the most relevant processes and direct elementary flows

Impact category	***Processes***
Most relevant impact category 1	· Process A (from life cycle stage X)
	· Process B (from life cycle stage Y)
Most relevant impact category 2	· Process A (from life cycle stage X)

	· Process B (from life cycle stage Y)
Most relevant impact category n	· Process A (from life cycle stage X)
	· Process B (from life cycle stage X)

B.5 Life cycle inventory

All newly created processes shall be EF-compliant, as defined in the OEFSR guidance this document is conform with.

[The OEFSR shall indicate if sampling is allowed. If the TS allows sampling, the OEFSR shall describe the sampling procedure as described in the guidance and contain a sentence like:] *In case sampling is needed, it shall be conducted as specified in this OEFSR. However, sampling is not mandatory and any applicant of this OEFSR may decide to collect the data from all the plants or farms, without performing any sampling.*

B.5.1 List of mandatory company-specific data

[The TS shall here indicate the list of mandatory company-specific activity data and list the processes to be modelled with company specific data]

Process A:

[Provide a short description of process A. List all the activity and foreground elementary flows that shall be collected and the sub-processes linked to the activity data within process A. Use the table below to introduce minimum one example in the OEFSR. In case not all processes are introduced here, the full list of all processes shall be include in an excel file.]

Data collection requirements for mandatory process A

Requirements for data collection purposes			**Requirements for modelling purposes**							
Activity data to be collected	*Specific requirements (e.g. frequency, measurement standard, etc.)*	*Unit of measure*	*Default dataset to be used*	*Dataset source (i.e. node)*	*UUID*	*TiR*	*TeR*	*GR*	*P*	*DQ*
Inputs:										
[Example: yearly	[Example: 3 year average]	[Example: kWh/year]	[Example: Electricity	[Example: http://lcdn.thinkstep.com/Node/]	[Example: 0af0a6a8-	[Example: 1.6]				

electricity use]			grid mix 1kV-60kV/AT]		aebc-4eeb-99f8-5ccf2304b99d]					
Outputs:										
…	…	…	…	…	…	…				

[List all the emissions and resources that shall be modelled with company-specific information within process A.]

Direct elementary flow collection requirements for mandatory process A

Emissions/resources	***Elementary flow***	***Frequency of measurement***	***Default measurement method***[89]	***Remarks***

See excel file named "[Name OEFSR_version number] - *Life cycle inventory" for the list of all company-specific data to be collected, downloadable at*: http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm.

B.5.2 List of processes expected to be run by the company

The following processes are expected to be run by the company applying the OEFSR:

- *Process X*
- *Process Y*
- *…*

Process X:

[Provide a short description of process X. List all the activity data and direct elementary flows that shall be collected and the sub-processes linked to the activity data within process X. Use the table below to introduce minimum one example in the OEFSR. In case not all processes are introduced here, the full list of all processes shall be include in an excel file.]

Table B. 4. Data collection requirements for process X:

[89] Unless specific measurement methods are foreseen in a country specific legislation

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	*Specific requirements (e.g. frequency, measurement standard, etc.)*	*Unit of measure*	*Default dataset to be used*	*Dataset source (i.e. node)*	*UUID*	*TiR*	*GR*	*TeR*	*P*	*DQR*	
Inputs:											
[Example: yearly electricity use]	[Example: 3 year average]	[Example: kWh/year]	[Example: Electricity grid mix 1kV-60kV/AT]	[Example: http://lcdn.thinkstep.com/Node/]	[Example: 0af0a6a8-aebc-4eeb-99f8-5ccf2304b99d]	[Example: 1.6]					
Outputs:											
…	…	…	…	…	…	…					

Direct elementary flow collection requirements for process X

Emissions/resources	Elementary flow	Frequency of measurement	Default measurement method[90]	Remarks

See excel file named "[Name OEFSR_version number] - *Life cycle inventory" for the list of all processes to be expected in situation 1, downloadable at*: http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm.

[90] Unless specific measurement methods are foreseen in a country specific legislation

B.5.3 Data gaps

[This section shall include:

- The list of data gaps on the company-specific data to be collected that are most frequently encountered by companies in the specific sectors and how these data gaps can be solved in the context of the OEF
- The list of data gaps in default datasets listed in the OEFSR;
- The list of processes excluded from the OEFSR due to missing datasets that shall not be filled in by the applicant;
- The list of processes for which proxies are to be used by OEF studies.

The TS may decide to indicate in the LCI excel file for which processes no datasets are available and therefore are considered data gaps and for which processes proxies are to be used]

B.5.4 Data quality requirements

The data quality of each dataset and the total EF study shall be calculated and reported. The calculation of the DQR shall be based on the following formula with 4 criteria:

$$DQR = \frac{TeR+GR+TiR+P}{4}$$ [Equation B.1]

where TeR is the Technological-Representativeness, GR is the Geographical-Representativeness, TiR is the Time-Representativeness, and P is the Precision/uncertainty. The representativeness (technological, geographical and time-related) characterises to what degree the processes and products selected are depicting the system analysed, while the precision indicates the way the data is derived and related level of uncertainty.

The next chapters provide tables with the criteria to be used for the semi-quantitative assessment of each criteria. If a dataset is constructed with company-specific activity data, company-specific emission data and secondary sub-processes, the DQR of each shall be assessed separately.

[The OEFSR may specify more stringent data quality requirements if appropriate for the sector in question and specify additional criteria for the assessment of data quality.]

B.5.4.1 Company-specific datasets

The score of criterion P cannot be higher than 3 while the score for TiR, TeR, and GR cannot be higher than 2 (the DQR score shall be ≤1.6). The DQR shall be calculated at the level-1 disaggregation, before any aggregation of sub-processes or elementary flows is performed. The DQR of company-specific datasets shall be calculated as following:

1) Select the most relevant sub-processes and direct elementary flows that account for at least 80% of the total environmental impact of the company-specific dataset, listing them from the most contributing to the least contributing one.

2) Calculate the DQR criteria TeR, TiR, GR and P for each most relevant process and each most relevant direct elementary flow. The values of each criterion shall be assigned based on Table B.5.

2.a) Each most relevant elementary flow consists of the amount and elementary flow naming (e.g. 40 g carbon dioxide). For each most relevant elementary flow, evaluate the 4 DQR criteria named $Te_{R\text{-}EF}$, $Ti_{R\text{-}EF}$, $G_{R\text{-}EF}$, P_{EF} in Table B.5. It shall be evaluated for example, the timing of the flow measured, for which technology the flow was measured and in which geographical area.

2.b) Each most relevant process is a combination of activity data and the secondary dataset used. For each most relevant process, the DQR is calculated by the applicant of the OEFSR as a combination of the 4 DQR criteria for activity data and the secondary dataset: (i) Ti_R and P shall be evaluated at the level of the activity data (named $Ti_{R\text{-}AD}$, P_{AD}) and (ii) Te_R, Ti_R and G_R shall be evaluated at the level of the secondary dataset used (named $Te_{R\text{-}SD}$, $Ti_{R\text{-}SD}$ and $G_{R\text{-}SD}$). As Ti_R is evaluated twice, the mathematical average of $Ti_{R\text{-}AD}$ and $Ti_{R\text{-}SD}$ represents the Ti_R of the most relevant process.

3) Calculate the environmental contribution of each most-relevant process and elementary flow to the total environmental impact of all most-relevant processes and elementary flows, in % (weighted using 13 EF impact categories, with the exclusion of the 3 toxicity-related ones). For example, the newly developed dataset has only two most relevant processes, contributing in total to 80% of the total environmental impact of the dataset:

- *Process 1 carries 30% of the total dataset environmental impact. The contribution of this process to the total of 80% is 37.5% (the latter is the weight to be used).*
- *Process 1 carries 50% of the total dataset environmental impact. The contribution of this process to the total of 80% is 62.5% (the latter is the weight to be used).*

4) Calculate the Te_R, Ti_R, G_R and P criteria of the newly developed dataset as the weighted average of each criterion of the most relevant processes and direct elementary flows. The weight is the relative contribution (in %) of each most relevant process and direct elementary flow calculated in step 3.

5) The applicant of the OEFSR shall the total DQR of the newly developed dataset using the equation B.2, where $\overline{Te_R}, \overline{G_R}, \overline{Ti_R}, \bar{P}$ are the weighted average calculated as specified in point 4).

$$DQR = \frac{\overline{Te_R}+\overline{G_R}+\overline{Ti_R}+\bar{P}}{4} \qquad \textit{[Equation B.2]}$$

NOTE: in case the newly developed dataset has most relevant processes filled in by non-EF compliant datasets (and thus without DQR), then these datasets cannot be included in step 4 and 5 of the DQR calculation. (1) The weight of step 3 shall be recalculated for the EF-compliant datasets only. Calculate the environmental contribution of each most-relevant EF compliant process and elementary flow to the total environmental impact of all most-relevant EF compliant processes and

elementary flows, in %. Continue with step 4 and 5. (2) The weight of the non-EF compliant dataset (calculated in step 3) shall be used to increase the DQR criteria and total DQR accordingly. For example:

- *Process 1 carries 30% of the total dataset environmental impact and is ILCD entry level compliant. The contribution of this process to the total of 80% is 37.5% (the latter is the weight to be used).*
- *Process 1 carries 50% of the total dataset environmental impact and is EF compliant. The contribution of this process to all most-relevant EF compliant processes is 100%. The latter is the weight to be used in step 4.*
- *After step 5, the parameters $\overline{Te_R}, \overline{G_R}, \overline{Ti_R}, \overline{P}$ and the total DQR shall be multiplied with 1.375.*

Table B. 5 How to assess the value of the DQR parameter for datasets with company-specific information. [Note that the reference years for criterion TiR may be adapted by the TS; more than one table may be included in the OEFSR].

	P_{EF} and P_{AD}	$Ti_{R\text{-}EF}$ and $Ti_{R\text{-}AD}$	$Ti_{R\text{-}SD}$	$Te_{R\text{-}EF}$ and $Te_{R\text{-}SD}$	$G_{R\text{-}EF}$ and $G_{R\text{-}SD}$
1	*Measured/calculated and externally verified*	*The data refers to the most recent annual administration period with respect to the EF report publication date*	*The EF report publication date happens within the time validity of the dataset*	*The elementary flows and the secondary dataset reflect exactly the technology of the newly developed dataset*	*The data(set) reflects the exact geography where the process modelled in the newly created dataset takes place*
2	*Measured/calculated and internally verified, plausibility checked by reviewer*	*The data refers to maximum 2 annual administration periods with respect to the EF report publication date*	*The EF report publication date happens not later than 2 years beyond the time validity of the dataset*	*The elementary flows and the secondary dataset is a proxy of the technology of the newly developed dataset*	*The data(set) partly reflects the geography where the process modelled in the newly created dataset takes place*
3	*Measured/calculated/literature and plausibility not checked by reviewer OR Qualified estimate based on calculations plausibility checked by reviewer*	*The data refers to maximum three annual administration periods with respect to the EF report publication date*	*Not applicable*	*Not applicable*	*Not applicable*
4-5	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*

B.5.5 Data needs matrix (DNM)

All processes required to model the product and outside the list of mandatory company-specific shall be evaluated using the DNM (see Table B. 7.). The DNM shall be used by the OEFSR applicant to evaluate which data is needed and shall be used within the modelling of its OEF, depending on the level of influence the applicant (company) has on the specific process. The following three cases are found in the DNM and are explained below:

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

Table B. 6. Data Needs Matrix (DNM)[91]. *Disaggregated datasets shall be used.

[91] The options described in the DNM are not listed in order of preference

		Most relevant process	Other process
Situation 1: process run by the company applying the OEFSR	**Option 1**	Provide company-specific data (as requested in the OEFSR) and create a company specific dataset partially disaggregated at least at level 1 (DQR ≤1.6). Calculate the DQR values (for each criteria + total)	
	Option 2		Use default secondary dataset in OEFSR, in aggregated form (DQR ≤3.0). Use the default DQR values
Situation 2: process <u>not</u> run by the company applying the OEFSR but with access to (company-)specific information	**Option 1**	Provide company-specific data (as requested in the OEFSR) and create a company specific dataset partially disaggregated at least at level 1 (DQR ≤1.6). Calculate the DQR values (for each criteria + total)	
	Option 2	Use company-specific activity data for transport (distance), and substitute the sub-processes used for electricity mix and transport with supply-chain specific EF compliant datasets (DQR ≤3.0). Re-evaluate the DQR criteria within the product specific context	
	Option 3		Use company-specific activity data for transport (distance), and substitute the sub-processes used for electricity mix and transport with supply-chain specific EF compliant datasets (DQR ≤4.0). Re-evaluate the DQR criteria within the product specific context
Situation 3: process <u>not</u> run by the company applying the OEFSR and <u>without</u> access to (company)-specific information	**Option 1**	Use default secondary dataset, in aggregated form (DQR ≤3.0). Re-evaluate the DQR criteria within the product specific context	
	Option 2		Use default secondary dataset in OEFSR, in aggregated form (DQR ≤4.0) Use the default DQR values

B.5.5.1 Processes in situation 1

For each process in situation 1 there are two possible options:

- *The process is in the list of most relevant processes as specified in the OEFSR or is not in the list of most relevant process, but still the company wants to provide company specific data (option 1);*

- *The process is not in the list of most relevant processes and the company prefers to use a secondary dataset (option 2).*

Situation 1/Option 1

For all processes run by the company and where the company applying the OEFSR uses company specific data. The DQR of the newly developed dataset shall be evaluated as described in section B.5.4.1.

Situation 1/Option 2

For the non-most relevant processes only, if the applicant decides to model the process without collecting company-specific data, then the applicant shall use the secondary dataset listed in the OEFSR together with its default DQR values listed here.

If the default dataset to be used for the process is not listed in the OEFSR, the applicant of the OEFSR shall take the DQR values from the metadata of the original dataset.

B.5.5.2 Processes in situation 2

When a process is not run by the company applying the OEFSR, but there is access to company-specific data, then there are three possible options:

- *The company applying the OEFSR has access to extensive supplier-specific information and wants to create a new EF-compliant dataset[92] (Option 1);*
- *The company has some supplier-specific information and want to make some minimum changes (Option 2).*
- *The process is not in the list of most relevant processes and the company prefers to use a secondary dataset (option 3).*

Situation 2/Option 1

For all processes run by the company and where the company applying the OEFSR uses company specific data. The DQR of the newly developed dataset shall be evaluated as described in section *B.5.4.1*.

Situation 2/Option 2

Company-specific activity data for transport are used and the sub-processes used for electricity mix and transport with supply-chain specific EF compliant datasets are substituted starting from the default secondary dataset provided in the OEFSR.

[92] The review of the newly created dataset is optional

[Please note that, the OEFSR lists all dataset names together with the UUID of their aggregated dataset. For this situation, the disaggregated version of the dataset is required.]

The applicant of the OEFSR shall make the DQR values of the dataset used context-specific by re-evaluating Te_R and Ti_R, using the table(s) provided [enter table numbers, e.g. table B.7]. The criteria G_R shall be lowered by 30%[93] and the criteria P shall keep the original value.

Situation 2/Option 3

Company-specific activity data for transport are used and the sub-processes used for electricity mix and transport with supply-chain specific EF compliant datasets are substituted starting from the default secondary dataset provided in the OEFSR.

In this case, the applicant of the OEFSR shall recalculate the DQR for the processes by taking the DQR values from the dataset and lowering the parameter G_R by 30%.

Table B. 7. *How to assess the value of the DQR criteria when secondary datasets are used.* [More than one table may be included in the OEFSR and entered in the section on life cycle stages]

	TiR	*TeR*	*G_R*
1	*The EF report publication date happens within the time validity of the dataset*	*The technology used in the EF study is exactly the same as the one in scope of the dataset*	*The process modelled in the EF study takes place in the country the dataset is valid for*
2	*The EF report publication date happens not later than 2 years beyond the time validity of the dataset*	*The technologies used in the EF study is included in the mix of technologies in scope of the dataset*	*The process modelled in the EF study takes place in the geographical region (e.g. Europe) the dataset is valid for*
3	*The EF report publication date happens not later than 4 years beyond the time validity of the dataset*	*The technologies used in the EF study are only partly included in the scope of the dataset*	*The process modelled in the EF study takes place in one of the geographical regions the dataset is valid for*
4	*The EF report publication date happens not later than 6 years beyond the time validity of the dataset*	*The technologies used in the EF study are similar to those included in the scope of the dataset*	*The process modelled in the EF study takes place in a country that is not included in the geographical region(s) the dataset is valid for, but sufficient similarities are estimated based on expert judgement.*
5	*The EF report publication date happens later than 6 years after the time validity of the dataset*	*The technologies used in the EF study are different from those included in the scope of the dataset*	*The process modelled in the EF study takes place in a different country than the one the dataset is valid for*

[93] In situation 2, option 2 it is proposed to lower the parameter G_R by 30% in order to incentivize the use of company specific information and reward the efforts of the company in increasing the geographic representativeness of a secondary dataset through the substitution of the electricity mixes and of the distance and means of transportation.

B.5.5.3 Processes in situation 3

When a process is not run by the company applying the OEFSR and the company does not have access to company-specific data, there are two possible options:

- *It is in the list of most relevant processes (situation 3, option 1)*
- *It is not in the list of most relevant processes (situation 3, option 2)*

Situation 3/Option 1

In this case, the applicant of the OEFSR shall make the DQR values of the dataset context-specific by re-evaluating Te_R, Ti_R and G_r, using the table(s) provided [enter table numbers, e.g. table B.7]. *The criteria P shall keep the original value.*

Situation 3/Option 2

For the non-most relevant processes, the applicant shall use the corresponding secondary dataset listed in the OEFSR together with its DQR values.

If the default dataset to be used for the process is not listed in the OEFSR, the applicant of the OEFSR shall take the DQR values from the metadata of the original dataset.

B.5.6 Which datasets to use?

The secondary datasets to be used by the applicant are those listed in this OEFSR. Whenever a dataset needed to calculate the OEF-profile is not among those listed in this OEFSR, then the applicant shall choose between the following options (in hierarchical order):

- *Use an EF-compliant dataset available on one of the following nodes:*
  - *http://eplca.jrc.ec.europa.eu/EF-node/*
  - *http://lcdn.blonkconsultants.nl*
  - *http://ecoinvent.lca-data.com*
  - *http://lcdn-cepe.org*
  - *https://lcdn.quantis-software.com/PEF/*
  - *http://lcdn.thinkstep.com/Node*
- *Use an EF-compliant dataset available in a free or commercial source;*
- *Use another EF-compliant dataset considered to be a good proxy. In such case this information shall be included in the "limitation" section of the PEF report.*
- *Use an ILCD-entry level-compliant dataset. In such case this information shall be included in the "data gap" section of the PEF report.*

B.5.7 How to calculate the average DQR of the study

In order to calculate the average DQR of the EF study, the applicant shall calculate separately the TeR, TiR, GR and P for the EF study as the weighted average of all most relevant processes, based on

their relative environmental contribution to the total single score (excluding the 3 toxicity-related ones). The calculation rules explained in chapter B.5.4 shall be used.

B.5.8 Allocation rules

[The OEFSR shall report which allocation rules shall be used by OEF studies and how the modelling/calculations shall be made. In case economic allocation is used, the calculation method on how to derive the allocation factors shall be fixed and prescribed in the OEFSR. The following template shall be used:]

Table B. 8. *Allocation rules*

Process	***Allocation rule***	***Modelling instructions***
[Example: Process A]	[Example: Physical allocation]	[Example: The mass of the different outputs shall be used. …]
…	…	

B.5.9 Electricity modelling

The guidelines in this section shall only be used for the processes where company-specific information is collected (situation 1 / Option 1, situation 2 / Option 1 of the DNM).

The following electricity mix shall be used in hierarchical order:

(i) Supplier-specific electricity product shall be used if:
- *(a) available, and*
- *(b) the set of minimum criteria to ensure the contractual instruments are reliable is met.*

(ii) The supplier-specific total electricity mix shall be used if:
- *(a) available, and*
- *(b) the set of minimum criteria that to ensure the contractual instruments are reliable is met.*

(iii) As a last option the 'country-specific residual grid mix, consumption mix' shall be used (available at http://lcdn.thinkstep.com/Node/). Country-specific means the country in which the life cycle stage occurs. This may be an EU country or non-EU country. The residual grid mix characterizes the unclaimed, untracked or publicly shared electricity. This prevents double counting with the use of supplier-specific electricity mixes in (i) and (ii).

Note: if for a country, there is a 100% tracking system in place, case (i) shall be applied.

Note: for the use stage, the consumption grid mix shall be used.

The environmental integrity of the use of supplier-specific electricity mix depends on ensuring that contractual instruments (for tracking) ***reliably and uniquely convey claims to consumers****. Without this, the OEF lacks the accuracy and consistency necessary to drive product/corporate electricity procurement decisions and accurate consumer (buyer of electricity) claims. Therefore, a set of minimum criteria that relate to the integrity of the contractual instruments as reliable conveyers of environmental footprint information has been identified. They represent the minimum features necessary to use supplier-specific mix within OEF studies.*

Set of minimal criteria to ensure contractual instruments from suppliers:

A supplier-specific electricity product/mix may only be used when the applicant ensures that any contractual instrument meets the criteria specified below. If contractual instruments do not meet the criteria, then 'country-specific residual grid mix, consumption mix' shall be used in the modelling.

A contractual instrument used for electricity modelling shall:

1. *Convey attributes:*
    - *Convey the energy type mix associated with the unit of electricity produced.*
    - *The energy type mix shall be calculated based on delivered electricity, incorporating certificates sourced and retired on behalf of its customers. Electricity from facilities for which the attributes have been sold off (via contracts or certificates) shall be characterized as having the environmental attributes of the country residual consumption mix where the facility is located.*
2. *Be a unique claim:*
    - *Be the only instruments that carry the environmental attribute claim associated with that quantity of electricity generated.*
    - *Be tracked and redeemed, retired, or cancelled by or on behalf of the company (e.g. by an audit of contracts, third-party certification, or may be handled automatically through other disclosure registries, systems, or mechanisms).*
3. *Be as close as possible to the period to which the contractual instrument is applied.*

[The TS may provide more information following the guidance]

Modelling 'country-specific residual grid mix, consumption mix':

Datasets for residual grid mix, per energy type, per country and per voltage have been purchased by the European Commission and are available in the dedicated node (http://lcdn.thinkstep.com/Node/). In case the necessary dataset is not available, an alternative dataset shall be chosen according to the procedure described in section above. If no dataset is available, the following approach may be used:

Determine the country consumption mix (e.g. X% of MWh produced with hydro energy, Y% of MWh produced with coal power plant) and combined them with LCI datasets per energy type and country/region (e.g. LCI dataset for the production of 1MWh hydro energy in Switzerland):

- *Activity data related to non-EU country consumption mix per detailed energy type shall be determined based on:*

    - *Domestic production mix per production technologies*
    - *Import quantity and from which neighbouring countries*
    - *Transmission losses*
    - *Distribution losses*
    - *Type of fuel supply (share of resources used, by import and / or domestic supply)*

  These data may be found in the publications of the International Energy Agency (IEA).

- *Available LCI datasets per fuel technologies in the node. The LCI datasets available are generally specific to a country or a region in terms of:*

    - *Fuel supply (share of resources used, by import and / or domestic supply),*
    - *Energy carrier properties (e.g. element and energy contents)*
    - *Technology standards of power plants regarding efficiency, firing technology, flue-gas desulphurisation, NOx removal and de-dusting.*

Allocation rules:

[When applicable, the OEFSR shall report which physical relationship shall be used by OEF studies: to subdivide the electricity consumption among multiple products for each process (e.g. mass, number of pieces, volume…). The following template shall be used:]

Table B. 9. ***Allocation rules for electricity***

Process	***Physical relationship***	***Modelling instructions***
Process A	*Mass*	
Process B	*N of pieces*	
…	*…*	

If the consumed electricity comes from more than one electricity mix, each mix source shall be used in terms of its proportion in the total kWh consumed. For example, if a fraction of this total kWh consumed is coming from a specific supplier a supplier-specific electricity mix shall be used for this part. See below for on-site electricity use.

[The OEFSR shall only include the following text if applicable:] *A specific electricity type may be allocated to one specific product portfolio in the following conditions:*

- *The production of the whole product portfolio (and related electricity consumption) occurs in a separate site (building), the energy type physical related to this separated site may be used.*
- *The production of the product portfolio (and related electricity consumption) occurs in a shared space with specific energy metering or purchase records or electricity bills for the portfolio, the portfolio specific information (measure, record, bill) may be used.*

<u>On-site electricity generation:</u>

If on-site electricity production is equal to the site own consumption, two situations apply:

- *No contractual instruments have been sold to a third party: the own electricity mix (combined with LCI datasets) shall be modelled.*
- *Contractual instruments have been sold to a third party: the 'country-specific residual grid mix, consumption mix' (combined with LCI datasets) shall be used.*

If electricity is produced in excess of the amount consumed on-site within the defined system boundary and is sold to, for example, the electricity grid, this system can be seen as a multifunctional situation. The system will provide two functions (e.g. product + electricity) and the following rules shall be followed:

- *If possible, apply subdivision.*
- *Subdivision applies both to separate electricity productions or to a common electricity production where you can allocate based on electricity amounts the upstream and direct emissions to your own consumption and to the share you sell out of your company (e.g. if a company has a wind mill on its production site and export 30% of the produced electricity, emissions related to 70% of produced electricity should be accounted in the OEF study.*
- *If not possible, direct substitution shall be used. The country-specific residual consumption electricity mix shall be used as substitution[94].*
- *Subdivision is considered as not possible when upstream impacts or direct emissions are closely related to the product itself.*

B.5.10 Climate change modelling

The impact category 'climate change' shall be modelled considering three sub-categories:

1. *Climate change – fossil: This sub-category includes emissions from peat and calcination/carbonation of limestone. The emission flows ending with '(fossil)' (e.g., 'carbon dioxide (fossil)'' and 'methane (fossil)') shall be used if available.*
2. *Climate change – biogenic: This sub-category covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or aboveground plant residues*

[94] For some countries, this option is a best case rather than a worst case.

such as litter and dead wood. Carbon exchanges from native forests[95] shall be modelled under sub-category 3 (incl. connected soil emissions, derived products, residues). The emission flows ending with '(biogenic)' shall be used.

A simplified modelling approach shall be used when modelling the foreground emissions: [to be answered by the TS: Yes/No] [If yes, the following text shall be included in the OEFSR: "*Only the emission 'methane (biogenic)' is modelled, while no further biogenic emissions and uptakes from atmosphere are included. When methane emissions can be both fossil or biogenic, the release of biogenic methane shall be modelled first and then the remaining fossil methane."*] [If no, the following text shall be included: "*All biogenic carbon emissions and removals shall be modelled separately. However, note that the corresponding characterisation factors for biogenic CO_2 uptakes and emissions within the EF impact assessment method are set to zero.*" The OEFSR shall provide complementary characterisation factors to be applied in case these flows are to be used to calculate additional environmental information and shall describe how the additional environmental information shall be calculated.]

[For OEFSRs with final products:]

Does the product life cycle or part of the life cycle has a carbon storage beyond 100 years and therefore credits from biogenic carbon storage shall be modelled: [to be answered by the TS: Yes/No] [If yes, the following text shall be included: "*Carbon credits shall be modelled by including an emission uptake as 'resource from air' using the elementary flow 'carbon dioxide (biogenic-100yr)'. Carbon credits shall be properly allocated among the different by-products the system delivered over the full timeframe (see respective chapters for more information).*" The OEFSR shall specify which proof needs to be provided in order to get the credits.]

[For OEFSRs with intermediate products:]

The biogenic carbon content at factory gate of each product of the product portfolio (physical content and allocated content) shall be reported as 'additional technical information'.

3. C*limate change – land use and land transformation: This sub-category accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (incl. soil carbon emissions). For native forests, all related CO_2 emissions are included and modelled under this sub-category (including connected soil emissions, products derived from native forest[96] and residues), while their CO_2 uptake is excluded. The emission flows ending with '(land use change)' shall be used.*

[95] Native forests – represents native or long-term, non-degraded forests. Definition adapted from table 8 in Annex V C(2010)3751 to Directive 2009/28/EC.

[96] Following the instantaneous oxidation approach in IPCC 2013 (Chapter 2).

For land use change, all carbon emissions and removals shall be modelled following the modelling guidelines of PAS 2050:2011 (BSI 2011) and the supplementary document PAS2050-1:2012 (BSI 2012) for horticultural products. PAS 2050:2011 (BSI 2011): Large emissions of GHGs can result as a consequence of land use change. Removals as a direct result of land use change (and not as a result of long-term management practices) do not usually occur, although it is recognized that this could happen in specific circumstances. Examples of direct land use change are the conversion of land used for growing crops to industrial use or conversion from forestland to cropland. All forms of land use change that result in emissions or removals are to be included. Indirect land use change refers to such conversions of land use as a consequence of changes in land use elsewhere. While GHG emissions also arise from indirect land use change, the methods and data requirements for calculating these emissions are not fully developed. Therefore, the assessment of emissions arising from indirect land use change is not included.

The GHG emissions and removals arising from direct land use change shall be assessed for any input to the life cycle of a product originating from that land and shall be included in the assessment of GHG emissions. The emissions arising from the product shall be assessed on the basis of the default land use change values provided in PAS 2050:2011 Annex C, unless better data is available. For countries and land use changes not included in this annex, the emissions arising from the product shall be assessed using the included GHG emissions and removals occurring as a result of direct land use change in accordance with the relevant sections of the IPCC (2006). The assessment of the impact of land use change shall include all direct land use change occurring not more than 20 years, or a single harvest period, prior to undertaking the assessment (whichever is the longer). The total GHG emissions and removals arising from direct land use change over the period shall be included in the quantification of GHG emissions of products arising from this land on the basis of equal allocation to each year of the period[97].

1) Where it can be demonstrated that the land use change occurred more than 20 years prior to the assessment being carried out, no emissions from land use change should be included in the assessment.

2) Where the timing of land use change cannot be demonstrated to be more than 20 years, or a single harvest period, prior to making the assessment (whichever is the longer), it shall be assumed that the land use change occurred on 1 January of either:

- *the earliest year in which it can be demonstrated that the land use change had occurred; or*
- *on 1 January of the year in which the assessment of GHG emissions and removals is being carried out.*

[97] In case of variability of production over the years , a mass allocation should be applied.

The following hierarchy shall apply when determining the GHG emissions and removals arising from land use change occurring not more than 20 years or a single harvest period, prior to making the assessment (whichever is the longer):

1. *where the country of production is known and the previous land use is known, the GHG emissions and removals arising from land use change shall be those resulting from the change in land use from the previous land use to the current land use in that country (additional guidelines on the calculations can be found in PAS 2050-1:2012);*
2. *where the country of production is known, but the former land use is not known, the GHG emissions arising from land use change shall be the estimate of average emissions from the land use change for that crop in that country (additional guidelines on the calculations can be found in PAS 2050-1:2012);*
3. *where neither the country of production nor the former land use is known, the GHG emissions arising from land use change shall be the weighted average of the average land use change emissions of that commodity in the countries in which it is grown.*

Knowledge of the prior land use can be demonstrated using a number of sources of information, such as satellite imagery and land survey data. Where records are not available, local knowledge of prior land use can be used. Countries in which a crop is grown can be determined from import statistics, and a cut-off threshold of not less than 90% of the weight of imports may be applied. Data sources, location and timing of land use change associated with inputs to products shall be reported.

Soil carbon storage shall be modelled, calculated and reported as additional environmental information: [to be answered by the TS: Yes/No] *[If yes, the OEFSR shall specify which proof needs to be provided and include the modelling rules.]*

The sum of the three sub-categories shall be reported.

The sub-category 'Climate change-biogenic' shall be reported separately: [to be answered by the TS: Yes/No]

The sub-category 'Climate change-land use and land transformation' shall be reported separately: [to be answered by the TS: Yes/No]

B.5.11 Modelling of wastes and recycled content

The waste of products used during the manufacturing, distribution, retail, the use stage or after use shall be included in the overall modelling of the life cycle of the organisation. Overall, this should be modelled and reported at the life cycle stage where the waste occurs. This section gives guidelines on how to model the End-of-Life of products as well as the recycled content.

[For final products:]

The Circular Footprint Formula is used to model the End-of-Life of products as well as the recycled content and is a combination of "material + energy + disposal", i.e.:

Material $(1 - R_1)E_V + R_1 \times \left(AE_{recycled} + (1 - A)E_V \times \frac{Q_{Sin}}{Q_p}\right) + (1 - A)R_2 \times \left(E_{recyclingEoL} - E_V^* \times \frac{Q_{Sout}}{Q_P}\right)$

Energy $(1 - B)R_3 \times (E_{ER} - LHV \times X_{ER,heat} \times E_{SE,heat} - LHV \times X_{ER,elec} \times E_{SE,elec})$

Disposal $(1 - R_2 - R_3) \times E_D$

[For construction products:]

The Circular Footprint Formula is used to model the End-of-Life of products as well as the recycled content:

Production burdens	$(1 - R_1)E_V + R_1 \times E_{recycled}$	**Cradle-to-gate**
Burdens and benefits related to secondary materials input	$-(1 - A)R_1 \times \left(E_{recycled} - E_V \times \frac{Q_{Sin}}{Q_P}\right)$	**Additional information from the EoL stage**
Burdens and benefits related to secondary materials output	$(1 - A)R_2 \times \left(E_{recyclingEoL} - E_V^* \times \frac{Q_{Sout}}{Q_P}\right)$	
Energy recovery	$(1 - B)R_3 \times (E_{ER} - LHV \times X_{ER,heat} \times E_{SE,heat} - LHV \times X_{ER,elec} \times E_{SE,elec})$	
Disposal	$(1 - R_2 - R_3) \times E_D$	

<u>With the following parameters:</u>

A: *allocation factor of burdens and credits between supplier and user of recycled materials.*

B: *allocation factor of energy recovery processes: it applies both to burdens and credits. It shall be set to zero for all OEF studies.*

Qs_{in}: *quality of the ingoing secondary material, i.e. the quality of the recycled material at the point of substitution.*

Qs_{out}: *quality of the outgoing secondary material, i.e. the quality of the recyclable material at the point of substitution.*

Q_p: *quality of the primary material, i.e. quality of the virgin material.*

R_1: *it is the proportion of material in the input to the production that has been recycled from a previous system.*

R_2: *it is the proportion of the material in the product that will be recycled (or reused) in a subsequent system. R2 shall therefore take into account the inefficiencies in the collection and recycling (or reuse) processes. R2 shall be measured at the output of the recycling plant.*

R_3: *it is the proportion of the material in the product that is used for energy recovery at EoL.*

$E_{recycled}$ (E_{rec}): *specific emissions and resources consumed (per functional unit) arising from the recycling process of the recycled (reused) material, including collection, sorting and transportation process.*

$E_{recyclingEoL}$ (E_{recEoL}): *specific emissions and resources consumed (per functional unit) arising from the recycling process at EoL, including collection, sorting and transportation process.*

E_v: *specific emissions and resources consumed (per functional unit) arising from the acquisition and pre-processing of virgin material.*

E^*_v: *specific emissions and resources consumed (per functional unit) arising from the acquisition and pre-processing of virgin material assumed to be substituted by recyclable materials.*

EER: *specific emissions and resources consumed (per functional unit) arising from the energy recovery process (e.g. incineration with energy recovery, landfill with energy recovery, …).*

$E_{SE,heat}$ and $E_{SE,elec}$: *specific emissions and resources consumed (per functional unit) that would have arisen from the specific substituted energy source, heat and electricity respectively.*

ED: *specific emissions and resources consumed (per functional unit) arising from disposal of waste material at the EoL of the analysed product, without energy recovery.*

$X_{ER,heat}$ and $X_{ER,elec}$: *the efficiency of the energy recovery process for both heat and electricity.*

LHV: *Lower Heating Value of the material in the product that is used for energy recovery.*

[Within the respective chapters, the following parameters shall be provided in the OEFSR:

- all A values to be used shall be listed, together with a reference to the guidance and Annex C.
- all quality ratios to be used, those that are OEFSR specific and those used for packaging.
- default R1 values for all default material datasets (in case no company-specific values are available), together with a reference to the guidance and Annex C. They shall be set to 0% when no application-specific data is available.
- default R2 values to be used in case no company-specific values are available, together with a reference to the guidance and Annex C]

B.6 Life cycle stages

B.6.1 Raw material acquisition and pre-processing

[The OEFSR shall list all technical requirements and assumptions to be used by the applicant. Furthermore, it shall list all processes taking place in this life cycle stage, according to the table provided below (transport in separate table). The table may be adapted by the TS as appropriate.]

Table B. 10. ***Raw material acquisition and processing (capitals indicate those processes expected to be run by the company)***

Process name*	***Unit of measurement (output)***	***Default***				***UUID***	***Default DQR***				***Most relevant process [Y/N]***
		R_1	***Amount per RU***	***Dataset***	***Dataset source***		*P*	*TiR*	*GR*	*TeR*	

[Please write in CAPITAL LETTERS the name of those processes expected to be run by the company]

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

[Packaging should be modelled as part of the raw material acquisition stage of the life cycle.]

[OEFSRs that include the use of beverage cartons or bag-in-box packaging shall/should provide information on the amounts input materials (also called the bill of material) and state that these packaging shall/should be modelled by combining the prescribed amounts of the material datasets with the prescribed conversion dataset.]

[OEFSRs that include reusable packaging from third party operated pools shall provide default reuse rates. OEFSRs with company owned packaging pools shall specify that the reuse rate shall be calculated using supply-chain-specific data only. The two different modelling approaches as presented in the OEFSR guidance shall be used and copied in the OEFSR. The OEFSR shall include the following: "*The raw material consumption of reusable packaging shall be calculated by dividing the actual weight of the packaging by the reuse rate.*"]

[For the different ingredients transported from supplier to factory, the OEFSR applicant needs data on (i) transport mode, (ii) distance per transport mode, (iii) utilization ratios for truck transport and (iv) empty return modelling for truck transport. The OEFSR shall provide default data for these or request these data in the list of mandatory company-specific information. The default values provided in the guidance shall be applied unless OEFSR-specific data is available. In case the

guidance is not applied, the reasoning shall be clearly explained and justified. The table below shall be used.]

Table B. 11. ***Transport (capitals indicate those processes expected to be run by the company)***

Process name	Unit of measurement (output)	Default (per RU)			Default data set	Data set source	UUID	Default DQR				Most relevant [Y/N]
		Distance	Utilisation ratio*	Empty return				P	TiR	GR	TeR	

**The applicant shall always check the utilisation ratio applied in the default dataset and adapt it accordingly.*

[Please write in CAPITAL LETTERS the name of those processes expected to be run by the company]

<u>Modelling the recycled content (If applicable)</u>

[If applicable the following text shall be included:]

The following formula is used to model the recycled content:

$$(1 - R_1)E_V + R_1 \times \left(AE_{recycled} + (1 - A)E_V \times \frac{Q_{Sin}}{Q_p} \right)$$

The R_1 values applied shall be supply-chain or default as provided in the table above, in relation with the DNM. Material-specific values based on supply market statistics are not accepted as a proxy. The applied R_1 values shall be subject to OEF study verification.

When using supply-chain specific R_1 values other than 0, traceability throughout the supply chain is necessary. The following general guidelines shall be followed when using supply-chain specific R_1 values:

- *The supplier information (through e.g., statement of conformity or delivery note) shall be maintained during all stages of production and delivery at the converter;*
- *Once the material is delivered to the converter for production of the end products, the converter shall handle information through their regular administrative procedures;*
- *The converter for production of the end products claiming recycled content shall demonstrate through his management system the [%] of recycled input material into the respective end product(s).*

- *The latter demonstration shall be transferred upon request to the user of the end product. In case an OEF profile is calculated and reported, this shall be stated as additional technical information of the OEF profile.*
- *Company-owned traceability systems can be applied as long as they cover the general guidelines outlined above.*

[Industry systems can be applied as long as they cover the general guidelines outlined above. In that case, the text above can be replaced by those industry specific rules. If not, they shall be supplemented with the general guidelines above.]

[Default parameters for A , Q_{sin}/Q_p and $E_{recycled}$ shall be selected by the TS from Annex C, at the point of substitution and per application or material, and shall be listed in a table in this section.]

[For intermediate products only:]

The OEF profile shall be calculated and reported using A equal to 1 for the product portfolio in scope. Under additional technical information the results shall be reported for different applications with the following A values:

Application	***A value to be used***

[For intermediate construction products only:]

The OEF profile shall be calculated and reported using the following formula:

$$(1 - R_1)E_V + R_1 \times E_{recycled}$$

The profile of the "Burdens and benefits related to secondary materials input" shall be calculated and reported under 'additional technical information' using the following A value [fill in].

Burdens and benefits related to secondary materials input:

$$-(1 - A)R_1 \times \left(E_{recycled} - E_V \times \frac{Q_{Sin}}{Q_p}\right)$$

[The default A values to be used shall be provided in the OEFSR]

B.6.2 Agricultural modelling (to be included only if applicable)

[In case agricultural production is part of the scope of the OEFSR the following text shall be included. Sections that are not relevant can be removed.]

Handling multi-functional processes: The rules described in the LEAP Guideline shall be followed: 'Environmental performance of animal feeds supply chains (pages 36-43), FAO 2015, available at http://www.fao.org/partnerships/leap/publications/en/'.

Use of crop type specific and country-region-or-climate specific data for yield, water and land use, land use change, fertiliser (artificial and organic) amount (N, P amount) and pesticide amount (per active ingredient), per hectare per year, if available.

Cultivation data shall be collected over a period of time sufficient to provide an average assessment of the life cycle inventory associated with the inputs and outputs of cultivation that will offset fluctuations due to seasonal differences:

- *For annual crops, an assessment period of at least three years shall be used (to level out differences in crop yields related to fluctuations in growing conditions over the years such as climate, pests and diseases, et cetera). Where data covering a three-year period is not available i.e. due to starting up a new production system (e.g. new greenhouse, newly cleared land, shift to other crop), the assessment may be conducted over a shorter period, but shall be not less than 1 year. Crops/plants grown in greenhouses shall be considered as annual crops/plants, unless the cultivation cycle is significantly shorter than a year and another crop is cultivated consecutively within that year. Tomatoes, peppers and other crops which are cultivated and harvested over a longer period through the year are considered as annual crops.*
- *For perennial plants (including entire plants and edible portions of perennial plants) a steady state situation (i.e. where all development stages are proportionally represented in the studied time period) shall be assumed and a three-year period shall be used to estimate the inputs and outputs[98].*
- *Where the different stages in the cultivation cycle are known to be disproportional, a correction shall be made by adjusting the crop areas allocated to different development stages in proportion to the crop areas expected in a theoretical steady state. The application of such correction shall be justified and recorded. The life cycle inventory of perennial plants and crops shall not be undertaken until the production system actually yields output.*
- *For crops that are grown and harvested in less than one year (e.g. lettuce produced in 2 to 4 months) data shall be gathered in relation to the specific time period for production of a single crop, from at least three recent consecutive cycles. Averaging over three years can best be done by first gathering annual data and calculating the life cycle inventory per year and then determine the three years average.*

Pesticide emissions shall be modelled as specific active ingredients. As default approach, the pesticides applied on the field shall be modelled as 90% emitted to the agricultural soil compartment, 9% emitted to air and 1% emitted to water.

[98] The underlying assumption in the cradle to gate life cycle inventory assessment of horticultural products is that the inputs and outputs of the cultivation are in a 'steady state', which means that all development stages of perennial crops (with different quantities of inputs and outputs) shall be proportionally represented in the time period of cultivation that is studied. This approach gives the advantage that inputs and outputs of a relatively short period can be used for the calculation of the cradle-to-gate life cycle inventory from the perennial crop product. Studying all development stages of a horticultural perennial crop can have a lifespan of 30 years and more (e.g. in case of fruit and nut trees).

Fertiliser (and manure) emissions shall be differentiated per fertilizer type and cover as a minimum:

- *NH_3, to air (from N-fertiliser application)*
- *N_2O, to air (direct and indirect) (from N-fertiliser application)*
- *CO_2, to air (from lime, urea and urea-compounds application)*
- *NO_3, to water unspecified (leaching from N-fertiliser application)*
- *PO_4, to water unspecified or freshwater (leaching and run-off of soluble phosphate from P-fertiliser application)*
- *P, to water unspecified or freshwater (soil particles containing phosphorous, from P-fertiliser application).*

The LCI for P emissions should be modelled as the amount of P emitted to water after run-off and the emission compartment 'water' shall be used. When this amount is not available, the LCI may be modelled as the amount of P applied on the agricultural field (through manure or fertilisers) and the emission compartment 'soil' shall be used. In this case, the run-off from soil to water is part of the impact assessment method.

The LCI for N emissions shall be modelled as the amount of emissions after it leaves the field (soil) and ending up in the different air and water compartments per amount of fertilisers applied. N emissions to soil shall not be modelled. The nitrogen emissions shall be calculated from Nitrogen applications of the farmer on the field and excluding external sources (e.g. rain deposition).

[For nitrogen based fertilisers, the OEFSR shall describe the LCI model to be used. The Tier 1 emissions factors of IPCC 2006 should be used. A more comprehensive Nitrogen field model can be used by the OEFSR provided (i) it covers at least the emissions requested above, (ii) N is balanced in inputs and outputs and (iii) it is described in a transparent way.]

Table B. 12. Parameters to be used when modelling nitrogen emission in soil.

Emission	***Compartment***	***Value to be applied***
N_2O (synthetic fertiliser and manure; direct and indirect)	*Air*	*0.022 kg N_2O/ kg N fertilizer applied*
NH_3 (synthetic fertiliser)	*Air*	*kg NH_3= kg N * FracGASF= 1*0.1* (17/14)= 0.12 kg NH_3/ kg N fertilizer applied*
NH_3 (manure)	*Air*	*kg NH_3= kg N*FracGASF= 1*0.2* (17/14)= 0.24 kg NH_3/ kg N manure applied*
NO_3^- (synthetic fertiliser and manure)	*Water*	*kg NO_3^-= kg N*FracLEACH = 1*0.3*(62/14) = 1.33 kg NO_3^-/ kg N applied*

Emission	*Compartment*	*Value to be applied*
P based fertilisers	*Water*	*0.05 kg P/ kg P applied*

[For TS, note that the values provided shall not be used to compare different types of synthetic fertilizers. More detailed modelling shall be used for that.]

Heavy metal emissions from field inputs shall be modelled as emission to soil and/or leaching or erosion to water. The inventory to water shall specify the oxidation state of the metal (e.g., Cr+3, Cr+6). As crops assimilate part of the heavy metal emissions during their cultivation clarification is needed on how to model crops that act as a sink. The following modelling approach shall be used:

[The TS shall select one of the two modelling approaches to be used]

- *The final fate of the heavy metals elementary flows are not further considered within the system boundary: the inventory does not account for the final emissions of the heavy metals and therefore shall not account for the uptake of heavy metals by the crop. For example, heavy metals in agricultural crops cultivated for human consumption end up in the plant. Within the EF context human consumption is not modelled, the final fate is not further modelled and the plant acts as a heavy metal sink. Therefore, the uptake of heavy metals by the crop shall not be modelled.*
- *The final fate (emission compartment) of the heavy metal elementary flows is considered within the system boundary: the inventory does account for the final emissions (release) of the heavy metals in the environment and therefore shall also account for the uptake of heavy metals by the crop. For example, heavy metals in agricultural crops cultivated for feed will mainly end up in the animal digestion and used as manure back on the field where the metals are released in the environment and their impacts are captured by the impact assessment methods. Therefore the inventory of the agricultural stage shall account for the uptake of heavy metals by the crop. A limited amount ends up in the animal (= sink), which may be neglected for simplification.*

Methane emissions from rice cultivation shall be included on basis of IPCC 2006 calculation rules.

Drained peat soils shall include carbon dioxide emissions on the basis of a model that relates the drainage levels to annual carbon oxidation.

The following activities shall be included [The TS shall select what shall be included following the OEFSR guidelines]:

- *Input of seed material (kg/ha)*
- *Input of peat to soil (kg/ha + C/N ratio)*
- *Input of lime (kg $CaCO_3$/ha, type)*
- *Machine use (hours, type) (to be included if there is high level of mechanisation)*
- *Input N from crop residues that stay on the field or are burned (kg residue + N content/ha)*

- *Crop yield (kg/ha)*
- *Drying and storage of products*
- *Field operations through …[to be filled in]*

B.6.3 Manufacturing

[The OEFSR shall list all technical requirements and assumptions to be used by the applicant. Furthermore, it shall list all processes taking place in this life cycle stage, according to the table provided below. The table may be adapted by the TS as appropriate.]

Table B. 13. ***Manufacturing (capitals indicate those processes expected to be run by the company)***

Process name	***Unit of measurement (output)***	***Default amount per RU***	***Default dataset***	***Dataset source***	***UUID***	***Default DQR***				***Most relevant process [Y/N]***
						P	*TiR*	*GR*	*TeR*	

[Please write in CAPITAL LETTERS the name of those processes expected to be run by the company]

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

[OEFSRs that include reusable packaging shall account for the additional energy and resource used for cleaning, repairing or refilling.]

The waste of products used during the manufacturing shall be included in the modelling. [Default loss rates per type of product and how these shall be included in the reference flow shall be described.]

B.6.4 Distribution stage [to be included if applicable]

The transport from factory to final client (including consumer transport) shall be modelled within this life cycle stage. The final client is defined as … [to be filled in].

In case supply-chain-specific information is available for one or several transport parameters, they may be applied following the Data Needs Matrix.

[A default transport scenario shall be provided by the TS in the OEFSR. In case no OEFSR-specific transport scenario is available the transport scenario provided in the guidance shall be used as a basis together with (i) a number of OEFSR-specific ratios, (ii) OEFSR-specific utilisation ratios for truck transport, and (iii) OEFSR-specific allocation factor for consumer transport. For reusable products, the return transport from retail/DC to factory shall be added in the transport scenario. For cooled or

frozen products, the default truck/van transport processes should be changed. The OEFSR shall list all processes using the table below. The table may be adapted by the TS as appropriate]

Table B.14. ***Distribution (capitals indicate those processes expected to be run by the company)***

Process name	*Unit of measurement (output)*	*Default (per RU)*			*Default dataset*	*Dataset source*	*UUID*	*Default DQR*				*Most relevant [Y/N]*
		Distance	*Utilisation ratio*	*Empty return*				*P*	*TiR*	*GR*	*TeR*	

[Please write in CAPITAL LETTERS the name of those processes expected to be run by the company]

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

The waste of products during the distribution and retail shall be included in the modelling. [Default loss rates per type of product and how these shall be included in the reference flow shall be described. The OEFSR shall follow the guidance Annex G in case no OEFSR-specific information is available.]

B.6.5 Use stage [to be included if applicable]

[The OEFSR shall provide a clear description of the use stage and list all processes taking place according to the table provided below. The table may be adapted by the TS as appropriate]

Table B.15. Use stage (capitals indicate those processes expected to be run by the company)

Name of the process	*Unit of measurement (output)*	*Default amount per RU*	*Default dataset to be used*	*Dataset source*	*UUID*	*Default DQR*				*Most relevant process [Y/N]*
						P	*TiR*	*GR*	*TeR*	

[Please write in CAPITAL LETTERS the name of those processes expected to be run by the company]

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

[In this section the OEFSR shall also list all technical requirements and assumptions to be used by the applicant. The OEFSR shall state if a delta approach is used for certain processes. In case the Delta approach is used, the OEFSR shall state the minimum consumption (reference) to be used when calculating the additional consumption allocated to the product.]

For the use stage the consumption grid mix shall be used. The electricity mix shall reflect the ratios of sales between EU countries/regions. To determine the ratio a physical unit shall be used (e.g. number of pieces or kg of product). Where such data are not available, the average EU consumption mix (EU-28 +EFTA), or region representative consumption mix, shall be used.

The waste of products during the use stage shall be included in the modelling. [Default loss rates per type of product shall be provided. The OEFSR shall follow the guidance Annex F in case no OEFSR-specific information is available.]

B.6.6 End-of-Life [to be included if applicable]

The End-of-Life stage is a life cycle stage that in general includes the waste of the PP in scope, such as the food waste, primary packaging, or the product left at its end of use.

[The OEFSR shall list all technical requirements and assumptions to be used by the applicant. Furthermore, it shall list all processes taking place in this life cycle stage according to the table provided below. The table may be adapted by the TS as appropriate. Please note that the transport from collection place to EOL treatment is included in the landfill, incineration and recycling datasets tendered by the EC. However, there might be some cases, where additional default transport data is needed and thus shall be included here. The guidance provides default values to be used in case no better data is available.]

Table B.16. End of Life (capitals indicate those processes expected to be run by the company)

Name of the process	***Unit of measurement (output)***	***Default amount per RU***	***Default dataset to be used***	***Dataset source***	***UUID***	***Default DQR***				***Most relevant process [Y/N]***
						P	*TiR*	*GR*	*TeR*	

[Please write in CAPITAL LETTERS the name of those processes expected to be run by the company]

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

The end of life shall be modelled using the formula and guidance provided in chapter 'End of life modelling' of this OEFSR together with the default parameters listed in the table below.

Before selecting the appropriate R_2 value, an evaluation for recyclability of the material shall be done and the OEF report shall include a statement on the recyclability of the materials/products. The statement on the recyclability shall be provided together with an evaluation for recyclability that includes evidence for the following three criteria (as described by ISO 14021:1999, section 7.7.4 'Evaluation methodology'):

1. *The collection, sorting and delivery systems to transfer the materials from the source to the recycling facility are conveniently available to a reasonable proportion of the purchasers, potential purchasers and users of the product;*
2. *The recycling facilities are available to accommodate the collected materials;*
3. *Evidence is available that the product for which recyclability is claimed is being collected and recycled.*

Point 1 and 3 can be proven by recycling statistics (country specific) derived from industry associations or national bodies. Approximation to evidence at point 3 can be provided by applying for example the design for recyclability evaluation outlined in EN 13430 Material recycling (Annexes A and B) or other sector-specific recyclability guidelines if available[99]*.*

Following the evaluation for recyclability, the appropriate R_2 values (supply-chain specific or default) shall be used. If one criteria is not fulfilled or the sector-specific recyclability guidelines indicate a limited recyclability an R_2 value of 0% shall be applied.

Company-specific R_2 values (measured at the output of the recycling plant) shall be used when available. If no company-specific values are available and the criteria for evaluation of recyclability are fulfilled (see below), application-specific R_2 values shall be used as listed in the table below,

- *If an R_2 value is not available for a specific country, then the European average shall be used.*
- *If an R_2 value is not available for a specific application, the R_2 values of the material shall be used (e.g. materials average).*
- *In case no R_2 values are available, R_2 shall be set equal to 0 or new statistics may be generated in order to assign an R_2 value in the specific situation.*

The applied R_2 values shall be subject to the OEF study verification.

[The OEFSR shall list in a table all the parameters to be used by the applicant to implement the CFF, distinguishing between those who have a fixed value (to be provided in the same table; from the guidance or OEFSR-specific) and those who are OEF study-specific (including R_2, A, $E_{recyclingEOL}$, …). Furthermore, the OEFSR shall include additional modelling rules derived from the guidance if applicable (e.g., on packaging). Within this table, the B value shall be equal to 0 as default.]

[99] E.g. the EPBP design guidelines (http://www.epbp.org/design-guidelines), or Recyclability by design (http://www.recoup.org/)

[OEFSRs that include reusable packaging shall include the following: *"The reuse rate determines the quantity of packaging material (per product sold) to be treated at end of life. The amount of packaging treated at end of life shall be calculated by dividing the actual weight of the packaging by the number of times this packaging was reused."]*

B.7 OEF results

B.7.1 OEF profile

The applicant shall calculate the OEF profile of its organisation in compliance with all requirements included in this OEFSR. The following information shall be included in the OEF report:

- full life cycle inventory;
- characterised results in absolute values, for all impact categories (including toxicity; as a table);
- normalised and weighted result in absolute values, for all impact categories (including toxicity; as a table);
- the aggregated single score in absolute values

B.7.2 Additional technical information

[The TS can decide to report additional technical information, this shall be listed here]:

-

[For Intermediate products:]

- *The biogenic carbon content (at factory gate (physical content and allocated content) shall be reported. If derived from native forest, it shall report that the corresponding carbon emissions shall be modelled with the elementary flow '(land use change)'.*
- *The recycled content (R_1) shall be reported.*
- *Results with application-specific A-values, if relevant.*

B.7.3 Additional environmental information

[Specify which additional environmental information shall/should be reported (provide units). Avoid if possible the use of should. Reference all methods used to report additional information.]

Biodiversity is considered as relevant for this OEFSR:… [YES/No]

[If biodiversity is relevant, the OEFSR shall describe how biodiversity impacts shall be assessed by the applicant.]

B.7.4 Other impact results

[This chapter is optional and may only be included in the OEFSR when the TS decides to add one or two toxicity impact categories to the list of most relevant impact categories. In this case, the TS may decide to display here the characterised results from the selected ICs toxicity.]

B.8 Verification

The verification of an EF study/report carried out in compliance with this OEFSR shall be done according to all the general requirements included in Section 8 of the latest version of the OEFSR Guidance and the requirements listed below.
The verifier(s) shall verify that the EF study is conducted in compliance with the most recent version of this OEFSR.
These requirements will remain valid until an EF verification scheme is adopted at European level or alternative verification approaches applicable to EF studies/report are included in existing or new policies.

B.8.1 Specific requirements for the verification

The verification of an EF study/report carried out in compliance with this OEFSR shall be done according to all the general requirements included in Section 8 of the OEFSR Guidance [enter version number] *and the requirements listed below.*

The verifier(s) shall verify that the EF study is conducted in compliance with this OEFSR.
These requirements will remain valid until an EF verification scheme is adopted at European level or alternative verification approaches applicable to EF studies/report are included in existing or new policies.

The verifier(s) shall validate the accuracy and reliability of the quantitative information used in the calculation of the study. As this can be highly resource intensive, the following requirements shall be followed:

- *the verifier shall check if the correct version of all impact assessment methods was used. For each of the most relevant impact categories, at least 50% of the characterisation factors (for each of the most relevant EF impact categories) shall be verified, while all normalisation and weighting factors of all ICs shall be verified. In particular, the verifier shall check that the characterisation factors correspond to those included in the EF impact assessment method the study declares compliance with[100];*
- *all the newly created datasets shall be checked on their EF compliancy (for the meaning of EF compliant datasets refer to Annex H of the Guidance). All their underlying data (elementary flows, activity data and sub processes) shall be validated. The aggregated EF-compliant dataset of the product in scope (meaning, the EF study) is available on the EF node (http://eplca.jrc.ec.europa.eu/EF-node/);*

[100] Available at: http://eplca.jrc.ec.europa.eu/LCDN/developer.xhtml

- *for at least 70% of the most relevant processes in situation 2 option 2 of the DNM, 70% of the underlying data shall be validated. The 70% data shall including all energy and transport sub processes for those in situation 2 option 2;*
- *for at least 60% of the most relevant processes in situation 3 of the DNM, 60% of the underlying data shall be validated;*
- *for at least 50% of the other processes in situation 1, 2 and 3 of the DNM, 50% of the underlying data shall be validated.*

In particular, it shall be verified for the selected processes if the DQR of the process satisfies the minimum DQR as specified in the DNM.

The selection of the processes to be verified for each situation shall be done ordering them from the most contributing to the less contributing one and selecting those contributing up to the identified percentage starting from the most contributing ones. In case of non-integer numbers, the rounding shall be made always considering the next upper integer.

These data checks shall include, but should not be limited to, the activity data used, the selection of secondary sub-processes, the selection of the direct elementary flows and the CFF parameters. For example, if there are 5 processes and each one of them includes 5 activity data, 5 secondary datasets and 10 CFF parameters, then the verifier(s) has to check at least 4 out of 5 processes (70%) and, for each process, (s)he shall check at least 4 activity data (70% of the total amount of activity data), 4 secondary datasets (70% of the total amount of secondary datasets), and 7 CFF parameters (70% of the total amount of CFF parameters), i.e. the 70% of each of data that could be possible subject of check.

The verification of the EF report shall be carried out by randomly checking enough information to provide reasonable assurance that the EF report fulfils all the conditions listed in section 8 of the OEFSR Guidance.

[The OEFSR may specify additional requirements for the verification that should be added to the minimum requirements stated in this document].

B.9 References

[List the references used in the OEFSR.]

ANNEX B.1 – List of EF normalisation and weighting factors

Global normalisation factors are applied within the EF. The normalisation factors as the global impact per person are used in the EF calculations.

Impact category	Unit	Normalisation factor	Normalisation factor per person	Impact assessment robustness	Inventory coverage completeness	Inventory robustness	Comment
Climate change	kg CO_2 eq	5.35E+13	7.76E+03	I	II	I	
Ozone depletion	kg CFC-11 eq	1.61E+08	2.34E-02	I	III	II	
Human toxicity, cancer	CTUh	2.66E+05	3.85E-05	II/III	III	III	
Human toxicity, non-cancer	CTUh	3.27E+06	4.75E-04	II/III	III	III	
Particulate matter	disease incidence	4.39E+06	6.37E-04	I	I/II	I /II	NF calculation takes into account the emission height both in the emission inventory and in the impact assessment.
Ionising radiation, human health	kBq U^{235} eq	2.91E+13	4.22E+03	II	II	III	
Photochemical ozone formation, human health	kg NMVOC eq	2.80E+11	4.06E+01	II	III	I/II	
Acidification	mol H+ eq	3.83E+11	5.55E+01	II	II	I/II	
Eutrophication, terrestrial	mol N eq	1.22E+12	1.77E+02	II	II	I/II	
Eutrophication, freshwater	kg P eq	1.76E+10	2.55E+00	II	II	III	
Eutrophication, marine	kg N eq	1.95E+11	2.83E+01	II	II	II/III	

Land use	pt	9.20E+15	1.33E+06	III	II	I I	The NF is built by means of regionalised CFs.
Ecotoxicity, freshwater	CTUe	8.15E+13	1.18E+04	II/III	III	III	
Water use	m^3 world $_{eq}$	7.91E+13	1.15E+04	III	I	II	The NF is built by means of regionalised CFs.
Resource use, fossils	MJ	4.50E+14	6.53E+04	III	I	II	
Resource use, minerals and metals	kg Sb $_{eq}$	3.99E+08	5.79E-02	III			

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	Aggregated weighting set	Robustness factors	Calculation	**Final weighting factors**
	(50:50)	(scale 1-0.1)		
WITHOUT TOX CATEGORIES	A	B	C=A*B	C scaled to 100
Climate change	15.75	0.87	13.65	**22.19**
Ozone depletion	6.92	0.6	4.15	**6.75**
Particulate matter	6.77	0.87	5.87	**9.54**
Ionizing radiation, human health	7.07	0.47	3.3	**5.37**
Photochemical ozone formation, human health	5.88	0.53	3.14	**5.1**
Acidification	6.13	0.67	4.08	**6.64**
Eutrophication, terrestrial	3.61	0.67	2.4	**3.91**
Eutrophication, freshwater	3.88	0.47	1.81	**2.95**
Eutrophication, marine	3.59	0.53	1.92	**3.12**
Land use	11.1	0.47	5.18	**8.42**
Water use	11.89	0.47	5.55	**9.03**
Resource use, minerals and metals	8.28	0.6	4.97	**8.08**
Resource use, fossils	9.14	0.6	5.48	**8.92**

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ANNEX B.2 – Check-list for the OEF study

[The OEFSR shall report as an annex the checklist listing all the items that shall be included in OEF studies. The following template shall be used. The items already included are mandatory for every OEFSR, in addition each TS can decide to add additional points to the checklist.]

Each OEF study shall include this annex, completed with all the requested information.

ITEM	***Included in the study (Y/N)***	***Section***	***Page***
[This column shall list all the items that shall be included in OEF studies. One item per row shall be listed. This column shall be completed by the TS.]	[The OEF study shall indicate if the item is included or not in the study.]	[The OEF study shall indicate in which section of the study the item is included.]	[The OEF study shall indicate in which page of the study the item is included]
Summary			
General information about the product portfolio			
General information about the company			
Diagram with system boundary and indication of the processes according to DNM			
List and description of processes included in the system boundaries			
List of co-products, by-products and waste			
List of activity data used			
List of secondary datasets used			
Data gaps			

Assumptions			
Scope of the study			
(sub)category to which the organization belongs (if applicable)			
DQR calculation of each dataset used for the most relevant processes and new ones created			
DQR (of each criteria and total) of the study			

ANNEX B.3 - Critical review report of the OEFSR

[Insert here the critical review panel report of the OEFSR, including all findings of the review process and the actions taken from TS to answer the comments of the reviewers]

ANNEX B.4 - Other Annexes

[The TS can decide to add other Annexes that are considered important]

Annex C - List of default values for A, R_1, R_2, R_3 and Qs/Qp

The list of default values for A, R_1, R_2 and R_3 is available in the Excel file "CFF_Default_Parameters_March2018.xlsx" downloadable at http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm.

Annex D – Background information used to calculate R_2 for packaging materials

Table D.1 presents per packaging sector (i) the data source to calculate R_2, (ii) where in the collection-recycling scheme these data are collected (see Figure 11) and (iii) the applied correction factor towards the output of the recycling process.

Table D.1 Recycling rates for different packaging categories, including the source, the data collection point and the recommended correction factor. Please note that the data sources used for the correction factor are not always reviewed reports but may also be surveys or standards.

Packaging sector	Data source	Reference year	Data collection point (Figure 11)	Correction factor*	Source for correction factor
Liquid beverage carton[b]	ACE	2014	8	Liquid packaging board: 92% Aluminium foil: 97% Plastic: 72%	No data source: The correction factors of paper and cardboard, aluminium cans, and generic plastics are recommended as proxy.
Aluminium cans	EA, + bottom ashes[p]	2013	6[†]	97%	Reviewed LCA: http://european-aluminium.eu/media/1329/environmental-profile-report-for-the-european-aluminium-industry.pdf (p58); Boin and Bertram 2005, Melting Standardized Aluminum Scrap: A Mass Balance Model for Europe.
PET bottle	PETCORE	2014	2	73%	Survey: Post-consumer PET recycling in Europe 2014 and prospects to 2019. Prepared on behalf of PETCORE Europe by PCI Ltd. 2015. http://www.pcipetpackaging.co.uk/
Container glass	FEVE	2013	8	90%	Reviewed LCA: Life Cycle Assessment of Container Glass in Europe (Prepared on behalf of FEVE by RDC Environment), 2016. http://feve.org/new-life-cycle-assessment-proves-industry-success-reducing-environmental-footprint/
Steel for packaging	APEAL, + bottom	2013	6[†]	98%	Standard: Canadian standards' Life cycle assessment of auto parts.

	ashes[ᵖ]				http://shop.csa.ca/en/canada/life-cycle-assessment/spe-14040-14/invt/27036702014
Generic plastic packaging	PlasticsEurope	2014	8	73%	LCA report: Increased EU Plastics Recycling Targets: Environmental, Economic and Social Impact Assessment. Prepared by Deloitte on behalf of Plastic Recyclers Europe. 2015 (See Table 7, value of 2012).
Paper and cardboard	CEPI	2014	8	92%	Reviewed LCA: European Database for Corrugated Board Life Cycle Studies" (2015, FEFCO, CE Containerboard)

**Expressed as percentage of material (%) at the output of the recycling plant when considering a 100% input at data collection point. The proposed correction factors are sector specific and to be used for correcting the European average and country specific recycling rates. It is recognized that this is an over simplification as the correction depends on the installations and market in place. However, the data available today asks for this simplification. Some values are rounded.*

[ᵖ]The recycling rates for aluminium cans and steel for packaging include bottom ash recovery.

[†]R_2 provided by the national collection systems excludes impurities from the overall mass estimate of metal packaging. Impurities are excluded from the correction factor.

[b] For liquid beverage carton three different material flows leave the recycling process at level Š. Therefore three correction factors are introduced, each to be used with the respective material flow.

Annex E - OEFSR supporting study template

IMPORTANT: The supporting studies shall be based on a version of the draft OEFSR that includes all the information that a person not involved in its drafting would need to carry out the study. If the version of the draft OEFSR approved by the Steering Committee is missing such information (e.g. the list of secondary datasets to be used, the tables to recalculate the DQR values for the secondary datasets, or other information related to data needs), than the TS shall make available to the companies performing the supporting study an updated version of the OEFSR. It is important to send this version also to the Commission as this will be one of the documents used by the verifiers for their checks.

General guidelines and instructions

The information included in this template is what the Commission expects to find in a supporting study. However, the use of a different template (with different chapters) is allowed provided that the information listed in this template is available in the report.

- Any information written in the referenced OEFSR shall not be repeated in this report.
- Any additional instructions (e.g., impact assessments methods used, default background datasets and parameters used) shall be included in the OEFSR and not in the supporting study report.
- In principle no deviations from the draft OEFSR are allowed. In case of deviation, the details about the deviation shall be described in the related chapter (meaning, when there is a deviation on the scope, this shall be described in the scope chapter).
- The supporting study report (including confidential information) will be accessed only by the external verifiers (Ernst & Young), the OEFSR reviewers, and the EF Team in DG ENV and JRC IES.
- The supporting study report (including confidential information) shall remain confidential, unless differently agreed by the company performing the study. The company performing the study can grant access to other stakeholders upon request.
- Beside the confidential report (this template in its full version), a second report shall be produced that describes the main outcomes of the OEFSR supporting study without disclosing confidential information. For this, chapter 0, 7.2 and 9 can be removed from the report, while chapter 6 on the results may be replaced by a non-confidential summary. This second report will be made available to the Technical Secretariat, the Technical Advisory Board and the Steering Committee.

The second report (without confidential information) or a condensed version thereof can be used in the communication phase.

Organisation Environmental Footprint

Supporting Study

[Insert company name here]

E.1 Summary

[The summary includes the following elements:

- The goal and scope of the supporting study
- Relevant statements about data quality, assumptions, value judgments and limitations
- The main results from the impact assessment
- Recommendations made and conclusions drawn

To the extent possible the Summary should be written with a non-technical audience in mind and should not be longer than 3-4 pages.

E.2 General

[The information below should ideally be placed on the front-page of the study:

- Name of the organization
- In case applicable, sub-set of the organisation's activities on which the study was carried out
- NACE code based on the latest NACE list version available and product portfolio covered
- Company presentation (name, geographic location)
- Date of publication of supporting study (write out the date e.g. 25 June 2015 to avoid confusion of the date format)
- Geographic validity of the supporting study (countries where the organisation or its sub-set are active)
- List the reference OEFSR the supporting study is in conformance with (incl. version number)
- An indication whether this report underwent a critical review process (critical review of the supporting study is not a mandatory requirement)]

[The following statements shall be included:

"The current document endeavours to be compliant with the requirements of the 'Organisation Environmental Footprint (OEF) Guide' (Annex III to Recommendation (2013/179/EU), the "Guidance for the implementation of the EU OEF during the EF Pilot Phase" (refer to the version valid at the time of the study) and the OEFSR … add title, version and publication date".

[Indicate the level of confidentiality of this report. The report will be public if it is used for communication purposes. The paragraph below can be used/adapted.

"*This supporting study report (in its full version) is confidential and will be accessed only by the external verifiers, the OEFSR reviewers, and the EF Team in DG ENV and JRC IES*"]

E.3 Goal of the study

[The following text shall be included:

"The supporting study is part of the PEF/OEF pilot phase and includes the following goals:

(i) To validate the rules of the draft OEFSR
(ii) To validate the outcomes of the screening study (such as the selection of relevant impact categories, life cycle stages, processes and elementary flows)
(iii) To establish whether it is feasible to compare the performance of two organisations in the same sector, and based on what indicators the comparison could be done
(iv) To perform supplementary analysis listed in the draft OEFSR
(v) To provide results that can be used as the basis for communicating the OEF profile"]

[Include any additional intended application.]

E.4 Scope of the study

E.4.1 Reporting unit and Product Portfolio

[Provide the reporting unit (functional unit) and the Product Portfolio, as described in the OEFSR]

E.4.2 System boundaries

[This section shall include as a minimum:

- Define the organisational boundary and the OEF boundary.
- List processes/ activities falling under the direct and indirect activities. Provide a list of processes/activities falling within the organizational boundaries that are needed/not needed to provide the product portfolio.
- Provide a system diagram clearly indicating the system boundaries, the processes that are included and those excluded, highlight activities falling under the different situations in the Data Need Matrix, and highlight where primary activity data / primary life cycle inventory data is used. In case a supporting study is not implementing the hotspot analysis, then the system diagram shall clearly indicate which are the processes in the company foreground system (where they have operational control) and which are those in the company background system]

E.4.3 Supplementary analysis

[Describe any supplementary analysis made, e.g.:

- Scenario sensitivity and uncertainty analysis
- Any other supplementary analysis listed in the draft OEFSR that needs further testing
- The use of impact assessment methods, end of life formulas or datasets other than those recommended in the OEFSR]

E.5 Life Cycle Inventory analysis

E.5.1 Data collection and quality assessment (CONFIDENTIAL IF RELEVANT)

[This section shall include as a minimum:

- Description and documentation of all primary data collected[101]
    - per life cycle stage, e.g., raw material acquisition, production, distribution and storage, use stage, end of life
    - list of activity data used
    - Reference to the representative product used (either based on an OEFSR screening or created for the purposes of the analysis) used to model the product portfolio or sub-categories within the product portfolio. In case the model is created during the OEF study, the parameters of the model shall be described.
    - List of primary datasets used
    - Reference to the secondary datasets used (if not feasible to list the secondary datasets used, refer to the database(s) including version used, linking them to specific elements in the product portfolio)
    - modelling parameters derived from primary data or additional to those described in the OEFSR (e.g. transportation distance, re-use rate for packaging, etc.)
- Primary data collection/estimation procedures, not specified in the draft OEFSR. Provide justification if any procedure deviates from requirements in the OEFSR
- Sources of published literature
- Validation of data, including documentation
- Report the data quality assessment scoring per process in accordance with the OEFSR requirements]

E.5.2 Data gaps

[Specify data gaps and the way in which these gaps were filled. Data gaps could refer to absolute gaps (e.g. a dataset or a relevant flow is missing) or it could refer to qualitative data gaps (e.g. a dataset is available but its DQR is higher than the minimum requested). This section is preferably empty and if not so, shall give recommendations to the final OEFSR development.]

E.5.3 Supplementary analysis

[This section shall describe more in detail the supplementary analysis made.

- Calculation procedure, assumptions, data sources used, etc.]

E.6 Impact assessment results (CONFIDENTIAL IF RELEVANT)

E.6.1 OEF results – Impact Assessment

[This section shall include as a minimum:

- List of the most relevant life cycle stages, processes and elementary flows based on the approach explained in this Guidance and/ or using any additional approach defined in the OEFSR.
- Characterised results per life cycle stage and impact category (all 16 OEF impact categories shall be calculated in the supporting study)

[101] A description on system level is required, i.e. the whole life cycle shall be described focussing on the most relevant parts thereof, resulting in e.g. 1-2 page summary. This is what the ILCD format foresees in the field "Technology description including background system". Generally, it is required a documentation that can directly be used to fill in the respective fields in the ILCD format for the resulting LCI results data set..

- Normalised and weighted results
- If included in OEFSR, the required additional environmental information
- Limitation of the EF results relative to the defined goal and scope of the OEF study

In case alternative impact assessment methods and/or normalisation factors and/or weighting systems are used, the results shall be calculated separately for the baseline OEF approach and for each of the alternative options included.]

E.6.2 Supplementary analysis

[This section shall include as a minimum:

- Results or conclusions of any supplementary analysis made]

E.7 Interpretation OEF results

E.7.1 OEF results

[This section shall include as a minimum:

- Comparison of the supporting study results against those of the screening study (relevant impact categories, life cycle stages, processes and elementary flows). Differences shall be described and explained, including a reflection on their relevance in the case of the specific sector;
- Any feedback on the draft OEFSR used, including suggestions for improvements, changes, additions
- Assessment of the degree of accuracy (technology, time, geography) for the newly created datasets;
- Average DQR for the supporting study (expressed as a mathematical average of the DQR of all datasets used in the study);
- Uncertainty (at least a qualitative description)].

E.7.2 Comparison to the benchmark

[To be completed if applicable. This section shall quantitatively report how the organisation scores against the benchmark defined at OEFSR level (in case no benchmark is explicitly stated in the OEFSR, the characterised results of the representative organisation are to be taken as basis for the benchmark) and following the same calculation rules. In any case, for the supporting studies, this comparison shall be done for each of the 16 impact categories[102].
Scores against the benchmark may be placed in a confidential annex.]

E.7.3 Performance class

[This section should only be filled in case the draft OEFSR includes a proposal for performance classes. If that is the case, here it should be reported how the specific organisation would score.]

[102] After the supporting studies, for communication purposes, the benchmark per impact category may be defined solely for the selected relevant impact categories.

E.8 Annex I

[The Annex serves to document supporting elements to the main report which are of a more technical nature. It could include:

- Bibliographic references;
- Additional results that have been shown to be not relevant;
- Life Cycle Inventory analysis (optional if considered sensitive and communicated separately in the Confidential annex, see below)]

E.9 Annex II: Confidential

[The Confidential annex is an optional chapter that shall contain all those data (including raw data) and information that are confidential or proprietary and cannot be made externally available.]

Annex F - Default data for modelling the use stage

The following tables shall be used by the OEFSRs unless better data is available. The data provided is based on assumptions, except if specified otherwise.

Product	Use stage assumptions per product category
Meat, fish, eggs	Chilled storage. Cooking: 10 minutes in frying pan (75% on gas and 25% electricity), 5 gram sunflower oil (incl. its life cycle) per kg product. Dishwashing of frying pan.
Milk	Chilled storage, drunk cold in 200 ml glass (i.e., 5 glasses per L milk), incl. glass life cycle and dishwashing.
Pasta	Per kg pasta cooked in pot with 10 kg water, 10 min boiling (75% on gas and 25% electricity). Boiling phase: 0.18 kWh per kg of water, Cooking phase: 0.05 kWh per minute of cooking.
Frozen dishes	Frozen storage. Cooked in oven 15 minutes at 200°C (incl. a fraction of a stove, a fraction of a baking sheet). Baking sheet rinsing: 5 L water.
Roast and ground coffee	7 g roast and ground coffee per cup Filter coffee preparation in a filter coffee machine: machine production and end-of-life (1.2 kg, 4380 uses, with 2 cups/use), paper filter (2 g/use), electricity consumption (33 Wh/cup) and water consumption (120 ml/cup). Machine rinsing/washing: 1 L cold water per use, 2 L hot water per 7 uses, decanter dishwashing (every 7 uses) Cup (mug) production and end-of-life and dishwashing Source: based on PEFCR Coffee (draft as of Feb 1, 2015)
Beer	Cooling (see next table), drunk in 33 cl glass (i.e., 3 glasses per L beer), glass production, end-of-life and dishwashing. For now: glass is excluded in the beer PEFCR.
Bottled water	Chilled storage. Storage duration: 1 day. 2.7 glasses per L water drunk, 250 gram glass production, end-of-life and dishwashing.
Pet food	Pet food dish production, end-of-life and dishwashing
Goldfish	Electricity and water use and treatment for the aquarium (43 kWh and 468 L per year). Goldfish feed production (1 g/day, assumed 50% fish meal, 50% soybean meal). Lifetime of the goldfish assumed to be 7.5 years.
T-shirt	Washing machine, tumble dryer use and ironing. 52 washing at 41 degree, 5.2 tumble drying (10%) and 30 times ironing per T-shirt.

	Washing machine: 70 kg, 50% steel, 35% plastic, 5% glass, 5% aluminium, 4% copper, 1% electronics, 1560 cycles (=loads) within its lifetime. 179 kWh and 8700 L water for 220 cycles at 8 kg load (based on http://www.bosch-home.com/ch/fr/produits/laver-et-s%C3%A9cher/lave-linge/WAQ28320FF.html?source=browse) being 0.81 kWh and 39.5 L/cycle, as well as 70 ml laundry detergent/cycle. Tumble dryer: 56 kg, same composition share and lifetime as for washing machine assumed. 2.07 kWh/cycle for 8 kg clothes load.
Paint	Paint brush production, sand paper, … (see PEFCR of paints).
Cell phone	2 kWh/year for the charge, 2 years lifetime.
Laundry detergent	Use of a washing machine (see T-shirt data for washing machine model). 70 ml laundry detergent assumed per cycle, i.e., 14 cycles per kg detergent.
Automotive oil	10% losses during use assessed as hydrocarbons emissions to water.

5577 Default assumptions for storage (always based on assumptions, except if specified otherwise):

Product	Assumptions common for several product categories
Ambient storage (at home)	Ambient storage at home is considered, for the sake of simplification, as having no impact.
Chilled storage (in a fridge, at home)	Storage time: product dependent. As default 7 days storage in fridge (ANIA and ADEME 2012). Storage volume: assumed to be 3x the actual product volume Energy consumption: 0.0037 kWh/L (i.e., “the storage volume”) - day (ANIA and ADEME 2012). Fridge production and end-of-life considered (assuming 15 years of lifetime).
Chilled storage (at the pub/restaurant)	The fridge at the pub is assumed to consume 1400 kWh/ yr (Heineken green cooling expert, 2015). 100% of this energy consumption is assumed to be for the cooling of beer. The throughput of the fridge is assumed to be 40hl/ yr. This means 0.035 kWh/ l for pub / supermarket cooling for the full storage time.

	Fridge production and end-of-life considered (assuming 15 years of lifetime).
Frozen storage (in a freezer, at home)	Storage time: 30 days in freezer (based on ANIA and ADEME 2012). Storage volume: assumed to be 2x the actual product volume. Energy consumption: 0.0049 kWh/L (i.e., "the storage volume") - day (ANIA and ADEME 2012). Freezer production and end-of-life considered (assuming 15 years of lifetime): assumed similar to fridge.
Cooking (at home)	Cooking: 1 kWh/h use (derived from consumptions for induction stove (0.588 kWh/h), ceramic stove (0.999 kWh/h) and electric stove (1.161 kWh/h) all from (ANIA and ADEME 2012). Backing in oven: electricity considered: 1.23 kWh/h (ANIA and ADEME 2012).
Dishwashing (at home)	Dishwasher use: 15 L water, 10 g soap and 1.2 kWh per washing cycle (Kaenzig and Jolliet 2006). Dishwasher production and end-of-life considered (assuming 1500 cycle per lifetime). When dishwashing is done by hand, one assumes an equivalent of 0.5 L of water and 1 g of soap for the value above of 2.5% (with a scaling in terms of water use and soap, using the % above). The water is assumed to be warmed by natural gas, considering a delta T of 40 °C and an efficiency of energy from natural gas heating to water heat of 1/1.25 (meaning that to heat the 0.5 L of water one needs to use 1.25 * 0.5 * 4186 * 40 = 0.1 MJ of "Heat, natural gas, at boiler").

Annex G - Default loss rates per type of product

Default loss rates per type of product during distribution and at consumer (including restaurant, etc.) (assumptions, unless specified otherwise). Out of simplification, the values for restaurant are considered the same as for consumer at home.

Retail trade sector	Category	Loss rate (incl. broken products but not products returned to manufacturer) during distribution (overall consolidated value for transportation, storage and retail place)	Loss rate at consumer (including restaurant, etc.)
Food	Fruits and vegetables	10% (FAO 2011)	19% (FAO 2011)
	Meat and meat alternatives	4% (FAO 2011)	11% (FAO 2011)
	Dairy products	0.5% (FAO 2011)	7% (FAO 2011)
	Grain products	2% (FAO 2011)	25% (FAO 2011)
	Oils and fats	1% (FAO 2011)	4% (FAO 2011)
	Prepared/processed meals (ambient)	10%	10%
	Prepared/processed meals (chilled)	5%	5%
	Prepared/processed meals (frozen)	0.6% (primary data based on Picard – oral communication from Arnaud Brulaire)	0.5% (primary data based on Picard – oral communication from Arnaud Brulaire)
	Confectionery	5%	2%
	Other foods	1%	2%
Beverages	Coffee and tea	1%	5%
	Alcoholic beverages	1%	5%

	Other beverages	1%	5%
Tobacco		0%	0%
Pet food		5%	5%
Live animals		0%	0%
Clothing and textile		10%	0%
Footwear and leather goods		0%	0%
Personal accessories	Personal accessories	0%	0%
Home and professional supplies	Home hardware supplies	1%	0%
	Furniture, furnishings and decor	0%	0%
	Electrical household appliances	1%	0%
	Kitchen merchandise	0%	0%
	Information and communication equipment	1%	0%
	Office machinery and supplies	1%	0%
Cultural and recreational goods	Books, newspapers and paper/paper supplies	1%	0%
	Music and videos	1%	0%
	Sporting equipment and	0%	0%

	gadgets		
	Other cultural and recreational goods	1%	0%
Healthcare		5%	5%
Cleaning/hygiene products, cosmetics and toiletries		5%	5%
Fuels, gases, lubricants and oils		1%	0%
Batteries and power		0%	0%
Plants and garden supplies	Flowers, plants and seeds	10%	0%
	Other garden supplies	1%	0%
Other goods		0%	0%
Gas station	Gas station products	1%	0%

Food losses at distribution centre, during transport and at retail place, and at home: assumed to be 50% trashed (i.e., incinerated and landfilled), 25% composting, 25% methanisation.

Product losses (excluding food losses) and packing/repacking/unpacking at distribution centre, during transport and at retail place: Assumed to be 100% recycled.

Other waste generated at distribution centre, during transport and at retailer (outside food and product losses) such as repacking/unpacking are assumed to follow the same EoL treatment as for home waste.

Liquid food wastes (as for instance milk) at consumer (including restaurant, etc.) are assumed to be poured in the sink and therefore treated in the wastewater treatment plant.

Annex H - When is carbon stored > 100 years?

When is carbon stored > 100 years and credits from biogenic carbon can be accounted for?

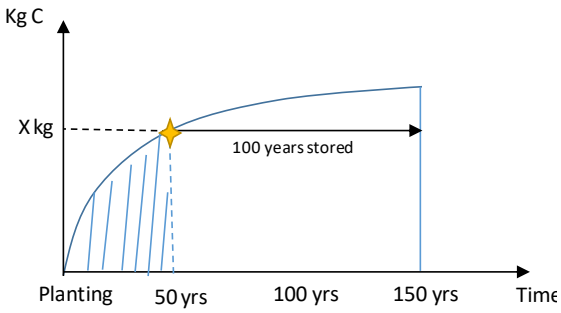
Principle: Carbon storage time starts from the moment carbon is taken up by the plant through photosynthesis and lasts till its release back into the atmosphere through e.g., degradation or incineration.

If X kg CO^2 is stored over 100 years, a -X kg CO_2 equivalents (minus X) can be accounted for and is also called carbon credit. This -X kg CO_2 equivalents is modelled by including an emission uptake as 'resource from air' using the elementary flow 'carbon dioxide (biogenic-100yr)'.

Situation 1. At the forest system: carbon storage starts at uptake by the plant.

Figure 12. Three examples for better understanding of the forest system.

A) Sustainable managed cork plantation of 150 years. Cork extraction every 10 years.



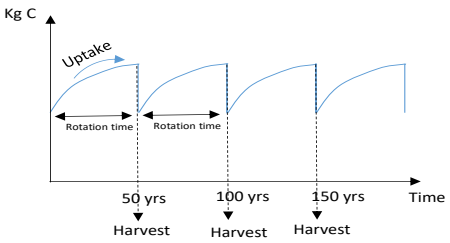
X kg C stored by the cork tree/by the system, over 100 years.

X kg C shall be allocated over all outputs of the total system (meaning, over 150 years)

B) Sustainable managed forest: Long-term rotation of 50 years

Sustainable managed reflects here in a stable carbon balance: C uptake = harvested C

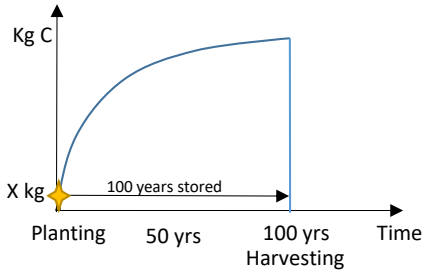
Rotation time = carbon storage time = 50 years



No carbon stored by the system over 100 years

The carbon storage time is co-determined by the product LT (see step 3)

C) Sustainable managed forest: wood harvested after 100 years.



Only X kg C in the tree is stored over 100 years. X kg is the amount after one year growth.

Legend:

X-axes: timeline, starting the carbon uptake at year zero.

Y-axes: accumulative carbon uptake in the system

Yellow star: year where carbon has been stored for minimum 100 years, and reflecting on the Y-axes the amount of carbon to be accounted for as credit (named X kg)

Situation 2. After the uptake in the forest system, the carbon storage continues in the final product.

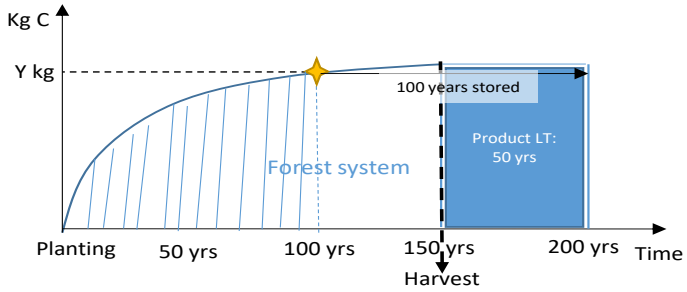
When the product lifetime (LT) is > 100 years: All carbon in the product is stored longer than 100 years: All product carbon gets a -1 credit

When the product LT is < 100 years: No carbon in the product is stored longer than 100 years: The carbon storage time is co-determined by the storage time in the forest system (see situation 3)

Situation 3. Carbon is stored in the forest system and the final product: carbon storage time in forest and carbon storage time in product determines if a carbon credit can be accounted for.

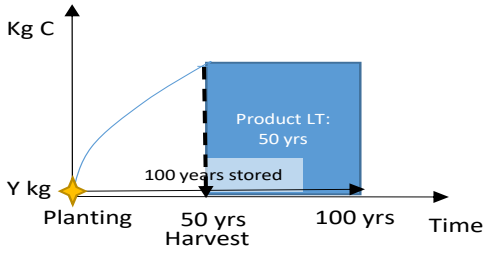
Figure 13. Two examples for better understanding of carbon stored in forest system and final product.

A) A forest plantation with harvested wood products after 150 years. The product LT is 50 years.



Y kg of carbon in the product is stored over 100 years (50yrs in the forest system + 50yrs in the product).

B) A forest plantation with harvested product after 50 years. The product LT is 50 years.



Only Y kg of carbon is stored over 100 years. Y kg is the amount after one year growth.

Legend:

X-axes: timeline, starting the carbon uptake at year zero and ending when the product is degraded/incinerated/…

Y-axes: accumulative carbon uptake in the system + product

Yellow star: year where carbon has been stored for minimum 100 years, and reflecting on the Y-axes the amount of carbon to be accounted for as credit (named Y kg)

Annex I - EF-compliant dataset

A basic requirement of the PEF and OEF methods is that LCI data used shall be compliant with the entry level (EL) requirements of the International Reference Life Cycle Data System (ILCD). Going beyond the ILCD EL requirements, the EF requirements provide further specifications to ILCD EL and refer to provisions e.g. in the Product Environmental Footprint (PEF) Guide (Rec 2013/179/EU - Annex II) or the Organisation Environmental Footprint (OEF) Guide (Rec 2013/179/EU - Annex III). In those cases the more specific (and sometimes more strict) EF requirements prevail over the ILCD EL requirements. Exceptions are allowed in case EF-compliant datasets are not available (see section 7.19.5).

The requirements listed in this Annex will be used for any future call for secondary datasets launched, starting from 1st January 2018, and will be the basis for determining the EF-compliance of any LCI dataset starting from 1st January 2021.

I.1 Technical requirements to be fulfilled by datasets being EF-compliant

I.1.1. Documentation

ILCD format shall be used. The developer kit is available at: http://eplca.jrc.ec.europa.eu/LCDN/developer.xhtml

Furthermore, the requirement available at: http://eplca.jrc.ec.europa.eu/uploads/QMS_H08_ENSURE_ILCD_GuidanceDocumentationLCADataSets_Version1-1Beta_2011_ISBN_clean.pdf shall be fulfilled.

The editor for datasets can be downloaded to: http://eplca.jrc.ec.europa.eu/LCDN/developer.xhtml

In the same page other tools and documents for the creation, editing and compliance validation of datasets are also available.

I.1.2. Nomenclature

Nomenclature shall be compliant with "ILCD Handbook – Nomenclature and other conventions" (including elementary flows see link for Elementary Flow list available at: http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml).

Details to fulfil this aspect are available at http://eplca.jrc.ec.europa.eu/uploads/MANPROJ-PR-ILCD-Handbook-Nomenclature-and-other-conventions-first-edition-ISBN-fin-v1.0-E.pdf

EF requirements allow some grouped flows (see the reference flow list available at http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml).

As grouped flows like "AOX" or "heavy metals" are not preferable in the impact assessment phase, the EF tries to avoid the use of such grouped flows and urges for further specification and the break-down of grouped flows into their single components.

I.1.3. Review

The review report shall include at least:

- File name and administrative information
  - Data set name
  - UUID (Universal Unique IDentifier)
  - Data set provider
  - Reviewer name(s) and affiliation(s), contact
  - Review type applied (see Table 36)
  - Date of review completion (DD/MM/YYYY)
  - EF compliance
- Review reporting items for the criterion “nomenclature”
- Review reporting items for the criterion “documentation”
- Review reporting items for the criterion “Methodological appropriateness and consistency. In particular, the reviewer shall check and report in the review report the % of impact covered for each impact category in order to fulfil the completeness criterion. This check shall be based on expert judgement and could be performed by comparing the coverage of flows existing in equivalent datasets available in other databases, or by referring to the elementary flows that contribute most to the JRC-provided normalisation data of the respective impact category.
- Review reporting items for the criterion “Data quality”. The list of items checked and the procedure used to check the data quality shall be included in the review report.
- Review for the Data Quality score, including a check of the results of the contribution analysis to determine the scoring of each parameter in the DQR formula.

Table 36. Typology of reviews

Typology and number of reviewers	Type 1	Panel of at least 3 independent reviewers, with at least one external
	Type 2	Two independent reviewers, with at least one external reviewer
	Type 3	Two independent internal reviewers
	Type 4	One independent external reviewer
	Type 5	One independent internal reviewer

I.1.4 Methodological requirements

In order to be considered EF-compliant a dataset shall fulfil all the modelling requirements described in sections 7.5–7.16 of this Guidance.

Moreover the following additional requirements shall also be fulfilled:

- **Completeness**: all 16 EF impact categories shall be covered in the dataset. The reviewer shall check that for each impact category the most important elementary flows are included.
- **Water use:** water use shall be modelled at country level using separate flows for water withdrawal, water release and water evaporation.

- **Cut off**: processes can be excluded up to 1.0%, based on material and energy flow and the level of environmental significance, but it has to be clearly checked, documented (i.e. the processes subject to cut-off have to be made explicit in the documentation) and confirmed by the reviewer, in particular with reference to the environmental significance of the cut-off applied. A cut-off higher than 1.0% per process and higher than 5% cumulative is not allowed and the dataset is considered as not-compliant with EF requirements.
- **Direct land use change**: Direct land use change shall be accounted for on the basis of a 20 year time period (starting from when the land use happened) and implemented in the calculation of 1) Climate Change according to the PAS2050-1:2012 method described at page 24 and 2) Land Use.
- **Carbon storage and delayed emissions**: credits associated with temporary (carbon) storage or delayed emissions up to 100 years shall not be considered.
- **Emissions off-setting:** not to be included
- **Capital goods (including infrastructures) and their End of life**: they shall be included unless they can be excluded based on the 1.0% cut-off rule. The eventual exclusion has to be clearly documented.
- **System boundaries**: system boundaries shall include all processes linked to the product supply chain (e.g. maintenance), unless they can be excluded based on the cut-off rule.
- **Time period**: emissions and removals shall be modelled as if released or removed at the beginning of the assessment period (no time discounting is allowed).
- The **biogenic carbon content** at factory gate (physical content and allocated content) shall be reported. If derived from native forest, it shall report that the corresponding carbon emissions shall be modelled with the elementary flow '(land use change)'.
- The **recycled content** (R_1) shall be reported.
- The LCIA shall be reported, specifying which version of the EF method has been used for the assessment.
- Calculation of Data Quality score.

I.2 Aggregation

An EF-compliant dataset should always be available both as aggregated and disaggregated dataset (minimum at level 1). The level 1 disaggregated dataset shall include, as a minimum, the following individual elements:

- Sub-processes for energy input(s) (differentiated by energy carrier, including any potential energy conversion of fuels and thus direct emissions, as “steam from [name of fuel]”, or “process heat from [name of fuel]”). For each sub-process, the exact dataset (name and uuid) used in the aggregated version of the dataset shall be indicated
- Sub-processes in case system expansion is used as allocation: the datasets used for substitution. For each sub-process, the exact dataset (name and uuid) used in the aggregated version of the dataset shall always be indicated;

- Sub-processes for each transport activity per input (material, ingredient, component, etc.) entering the gate of the process modelled[103]. For each sub-process, the exact dataset (name and uuid) used in the aggregated version of the dataset shall always be indicated;
- One aggregated sub-process for all the other processes that represent the background system (blue box in Figure 14. The exact dataset (name and uuid) used in the aggregated version of the dataset shall always be indicated).
- The output product flow;
- Elementary flows of direct emissions and resource outputs of the foreground system constituting the final output product.
- Elementary flows of direct resource inputs (e.g., land use, water use) of the foreground system constituting the final output product.

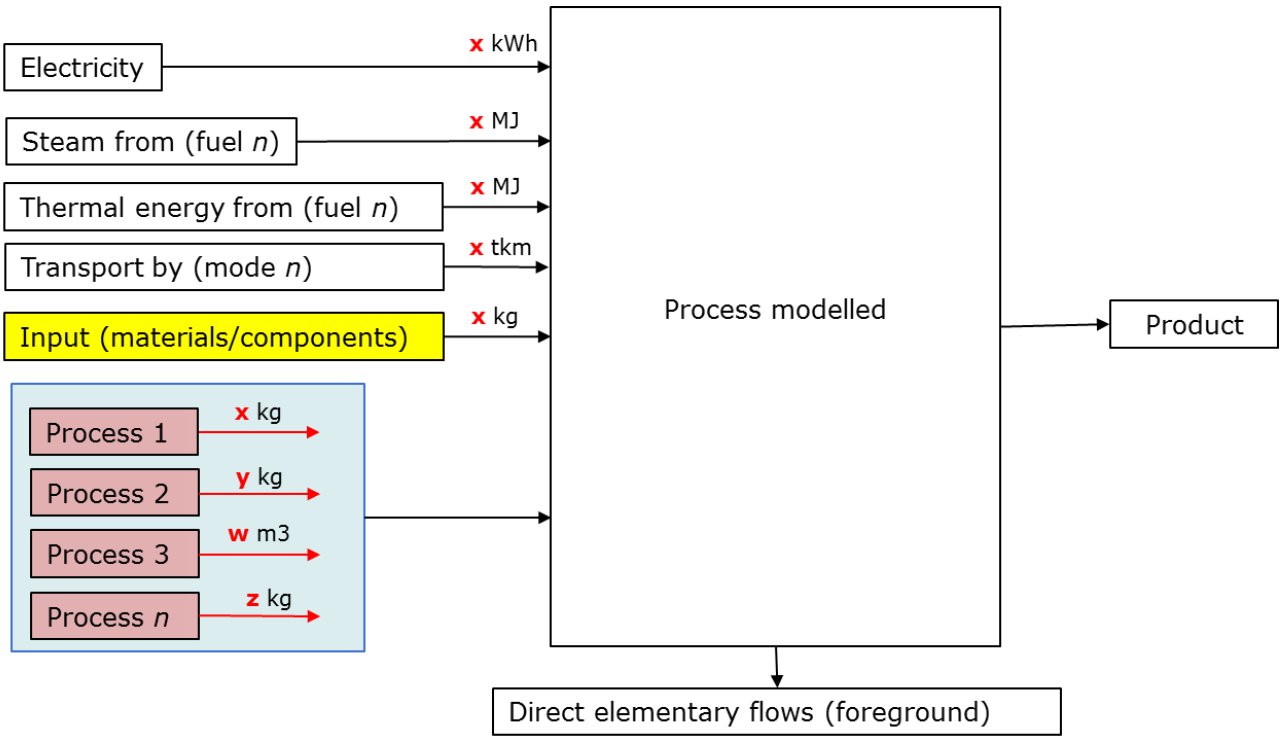


Figure 14. Minimum level of disaggregation requested for a dataset aggregated at level 1. The yellow box is optional when going beyond the minimum requirements.

[103] Some EF datasets tendered during the pilot phase might have one transport mode for all inputs summed together.

I.3 Data quality criteria and scores

The DQR of a dataset shall be calculated based on equation I.1[104]:

$$DQR = \frac{TeR+GR+TiR+P}{4} \quad \text{[Equation I.1]}$$

Where TeR is the Technical Representativeness, GR is the Geographical Representativeness, TiR is the Time Representativeness and P is the precision.

The DQR shall be calculated before any aggregation of sub-processes or elementary flows is performed. In particular, the procedure shall be applied before the creation of the aggregated sub-process of the level-1 disaggregated dataset (the "blue box" in Figure 14). For datasets based on company-specific data the procedure described in section 7.19.4.3 applies.

For secondary datasets (e.g., developed by databases) the following procedure applies[105]:

1) Select the most relevant sub-processes and direct (foreground) elementary flows that account for at least 80% of the total environmental impact of the dataset, listing them from the most contributing to the least contributing one;

2) Calculate the DQR criteria Te_R, Ti_R, G_R and P for each most relevant process and each most relevant direct elementary flow. The values of each criterion shall be assigned based on Table 37.

2.a) Each most relevant elementary flow consists of the amount and elementary flow naming (e.g. 40 g carbon dioxide). For each most relevant elementary flow, evaluate the 4 DQR criteria named $Te_{R\text{-}EF}$, $Ti_{R\text{-}EF}$, $G_{R\text{-}EF}$, P_{EF}. For example, evaluate the timing of the flow measured, for which technology the flow was measured and in which geographical area.

2.b) Each most relevant process is a combination of activity data and the secondary dataset used. For each most relevant process, the 4 DQR criteria are calculated as follow: (i) Ti_R and P shall be evaluated at the level of the activity data (named $Ti_{R\text{-}AD}$, P_{AD}), while (ii) Te_R, Ti_R and G_R shall be evaluated at the level of the secondary dataset used (named $Te_{R\text{-}SD}$, $Ti_{R\text{-}AD}$ and $G_{R\text{-}SD}$). As Ti_R is evaluated twice, the mathematical average of the activity data and secondary dataset represents the Ti_R of the most relevant process.

3) Calculate the environmental contribution of each most-relevant process and elementary flow to the total environmental impact of all most-relevant processes and elementary flows, in % (weighted using 13 EF impact categories, with the exclusion of the 3 toxicity-related ones). For example, the newly developed dataset has only two most relevant processes, contributing in total to 80% of the total environmental impact of the dataset:

[104] The EF datasets tendered during the pilot phase might apply a different approach, like expert judgement. The approach used is clarified in the respective dataset meta data information.

[105] For datasets based on company-specific data the procedure described in section 7.19.4.37.19.4.3 applies.

- Process 1 carries 30% of the total dataset environmental impact. The contribution of this process to the total of 80% is 37.5% (the latter is the weight to be used).
- Process 1 carries 50% of the total dataset environmental impact. The contribution of this process to the total of 80% is 62.5% (the latter is the weight to be used).

4) Calculate separately the Te_R, Ti_R, G_R and P for the secondary dataset as the weighted average of each criteria of the most relevant sub-processes and most relevant direct elementary flows. The weight is the relative contribution (in %) of each most relevant process and direct elementary flow calculated in step 3.

5) Calculate the total DQR of the secondary dataset using equation I.1, where $\overline{Te_R}, \overline{G_R}, \overline{Ti_R}, \bar{P}$ are the weighted averages calculated as specified in point 4. In order to be EF-compliant, each single criteria in cannot be higher than 3.0.

Table 37. Quality rating for the data quality criteria.

Quality rating	P_{EF} and P_{AD}	$Ti_{R\text{-}EF}$ and $Ti_{R\text{-}AD}$	$Ti_{R\text{-}SD}$	$Te_{R\text{-}EF}$ and $Te_{R\text{-}SD}$	$G_{R\text{-}EF}$ and $G_{R\text{-}SD}$
1	Measured/calculated and verified	The data (collection date) can be maximum 2 years old with respect to the "reference year" of the dataset.	The "reference year" of the tendered dataset falls within the time validity of the secondary dataset	Technology aspects have been modelled exactly as described in the title and metadata, without any significant need for improvement	The processes included in the dataset are fully representative for the geography stated in the "location" indicated in the metadata
2	Measured/calculated/literature and plausibility checked by reviewer	The data (collection date) can be maximum 4 years old with respect to the "reference year" of the dataset.	The "reference year" of the tendered dataset is maximum 2 years beyond the time validity of the secondary dataset	Technology aspects are very similar to what described in the title and metadata with need for limited improvements. For example: use of generic technologies' data instead of modelling all the single plants.	The processes included in the dataset are well representative for the geography stated in the "location" indicated in the metadata
3	Measured/calculated/literature and plausibility not checked by reviewer OR Qualified estimate based on calculations plausibility checked by reviewer	The data (collection date) can be maximum 6 years old with respect to the "reference year" of the dataset.	The "reference year" of the tendered dataset is maximum 3 years beyond the time validity of the secondary dataset	Technology aspects are similar to what described in the title and metadata but merits improvements. Some of the relevant processes are not modelled with specific data but using proxies.	The processes included in the dataset are sufficiently representative for the geography stated in the ""location" indicated in the metadata. E.g. the represented country differs but has a very similar electricity grid mix profile,
4	Qualified estimate based on calculations, plausibility not checked by reviewer	The data (collection date) can be maximum 8 years old with respect to the "reference year" of the dataset.	The "reference year" of the tendered dataset is maximum 4 years beyond the time validity of the secondary dataset	Technology aspects are different from what described in the title and metadata. Requires major improvements.	The processes included in the dataset are only partly representative for the geography stated in the "location" indicated in the metadata. E.g. the represented country differs and has a substantially different

					electricity grid mix profile
5	Rough estimate with known deficits	The data (collection date) is older than 8 years with respect to the "reference year" of the dataset.	The "reference year" of the tendered dataset is more than 4 years beyond the time validity of the secondary dataset	Technology aspects are completely different from what described in the title and metadata. Substantial improvement is necessary	The processes included in the dataset are not representative for the geography stated in the ""location" indicated in the metadata.

$Ti_{R\text{-}EF}$: time representativeness for the elementary flow
$Ti_{R\text{-}AD}$: time representativeness for the activity data
$Ti_{R\text{-}SD}$: time representativeness for the secondary dataset

How to report the DQR for the datasets: The dataset shall state as meta-data one numerical value for each DQR criteria (namely $\overline{Te_R}$; $\overline{G_R}$; $\overline{Ti_R}$; $\bar{P}$) and the total DQR numerical value, always referred to the dataset.