Diving into the details of PEF/OEF

Training 26 May 2019, UNEP/SETAC Conference Helsinki

26 May 2019

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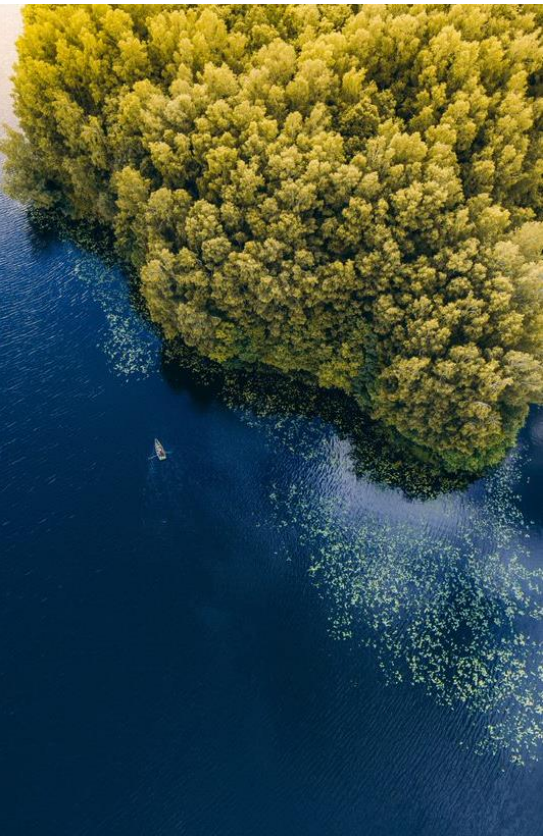
Agenda



Welcome by UNEP (09:00 -09:20)

Introduction and basics (09:20 – 10:00)

Morning coffee break (10:00 – 10:15)

Getting ready (10:15 – 10:45)

Modelling requirements (10:45 – 12:00)

Lunch break (12:00 – 13:00)

Data requirements (13:00 – 13:30)

EF compliant data sets (13:30 – 14:00)

Impact assessment and interpretation (14:00 – 14:45)

Afternoon coffee break (14:45 – 15:00)

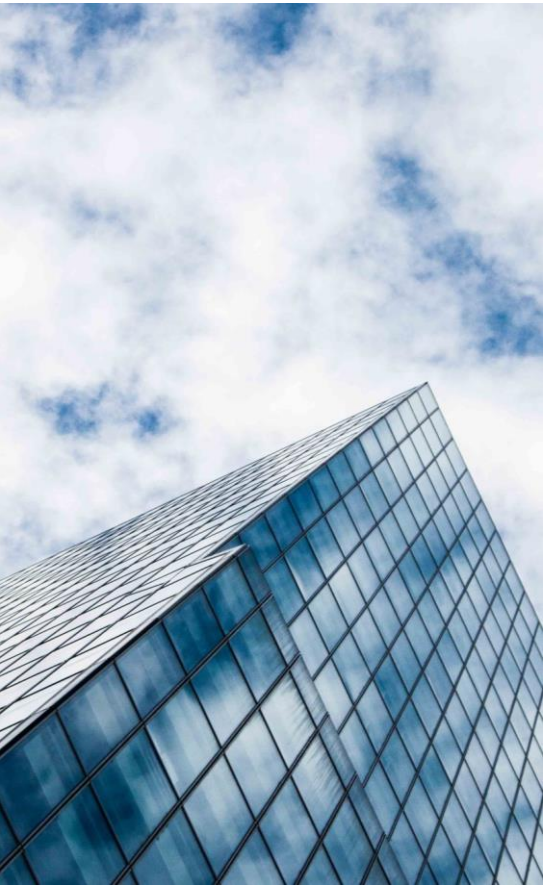
Group work (15:00 – 16:00)

Reporting and verification (16:00 – 16:30)

Questions, summary and wrap up (16:30 – 17:00)

Introduction and Basics

The Bigger Picture

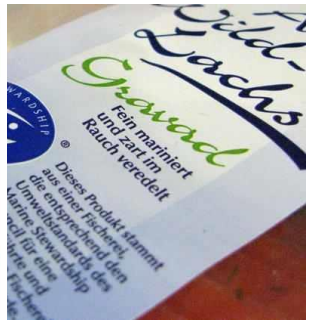


- Integrated Product Policy
  - LCA is the foundation (→ European Platform on LCA, ILCD Handbook → Environmental Footprint)
- Circular Economy Strategy
  - The European Commission adopted a comprehensive report on the implementation of the Circular Economy Action Plan (4 March, 2019)
  - Assessment to what extent EU policy tools are supporting circular, sustainable products
- Towards a sustainable Europe by 2030
  - "*Life-cycle assessments of products should become a norm and the eco-design framework should be broadened as much as possible*" (30 January, 2019)

Proliferation of Labels

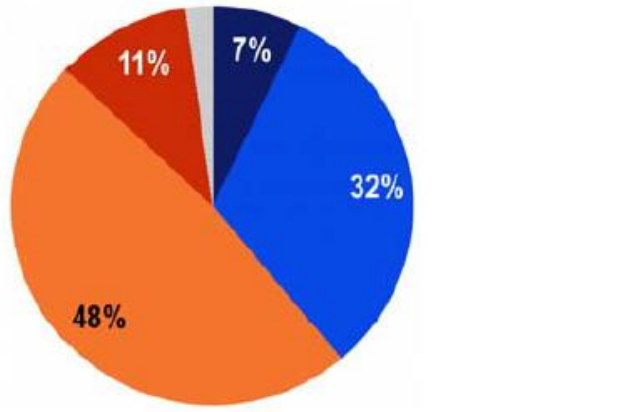
thinkstep maki Consulting GmbH Life cycle expert services SGS

> 400 labels…



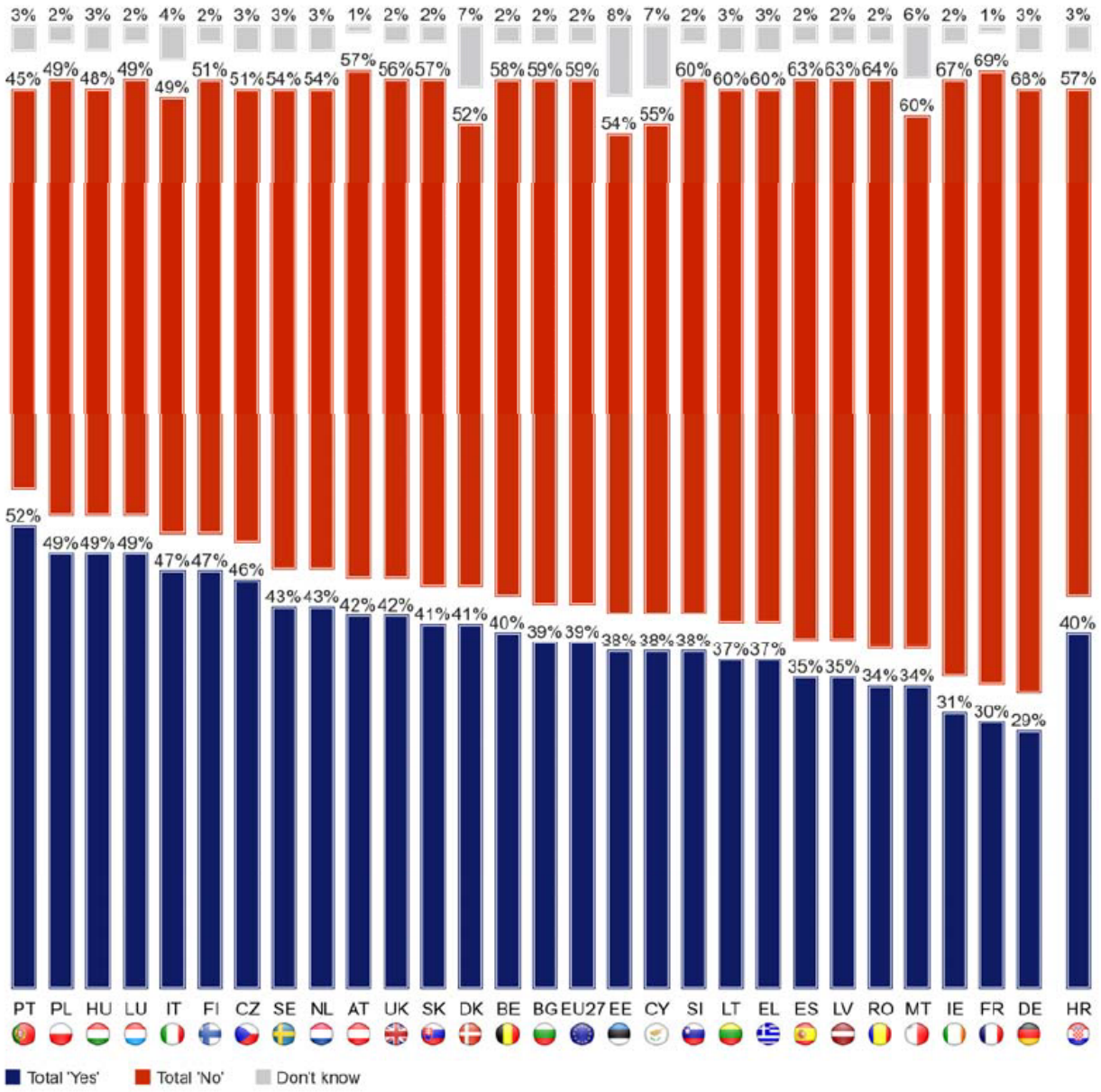
Eurobarometer (2013)

Q10. Do you think that current products labels provide enough information about their environmental impact in (OUR COUNTRY)?



Base: All respondents = 25568

Q10. Do you think that current product labels provide enough information about their environmental impact in (OUR COUNTRY)?



Environmental Footprint Initiative: Why?

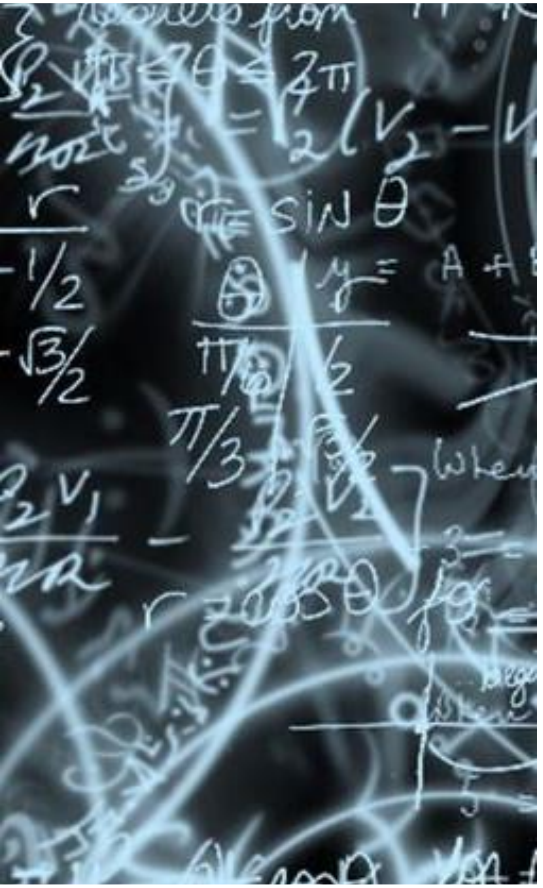
For consumers

Choosing the right product and understanding labels

For green producers

Fair competition against false green claims

Features of the EF Initiative



- A single set of rules valid for the European market (PEFCR/OEFSR)
- Definition of a representative product/organization
- Benchmarks
- Materiality Approach (focus where it counts)

Integration of existing knowledge (LCA studies, corporate GHG reporting, GRI, EMS) with new requirements (method, data; and specific for product groups or sectors)

Environmental Footprint: How?

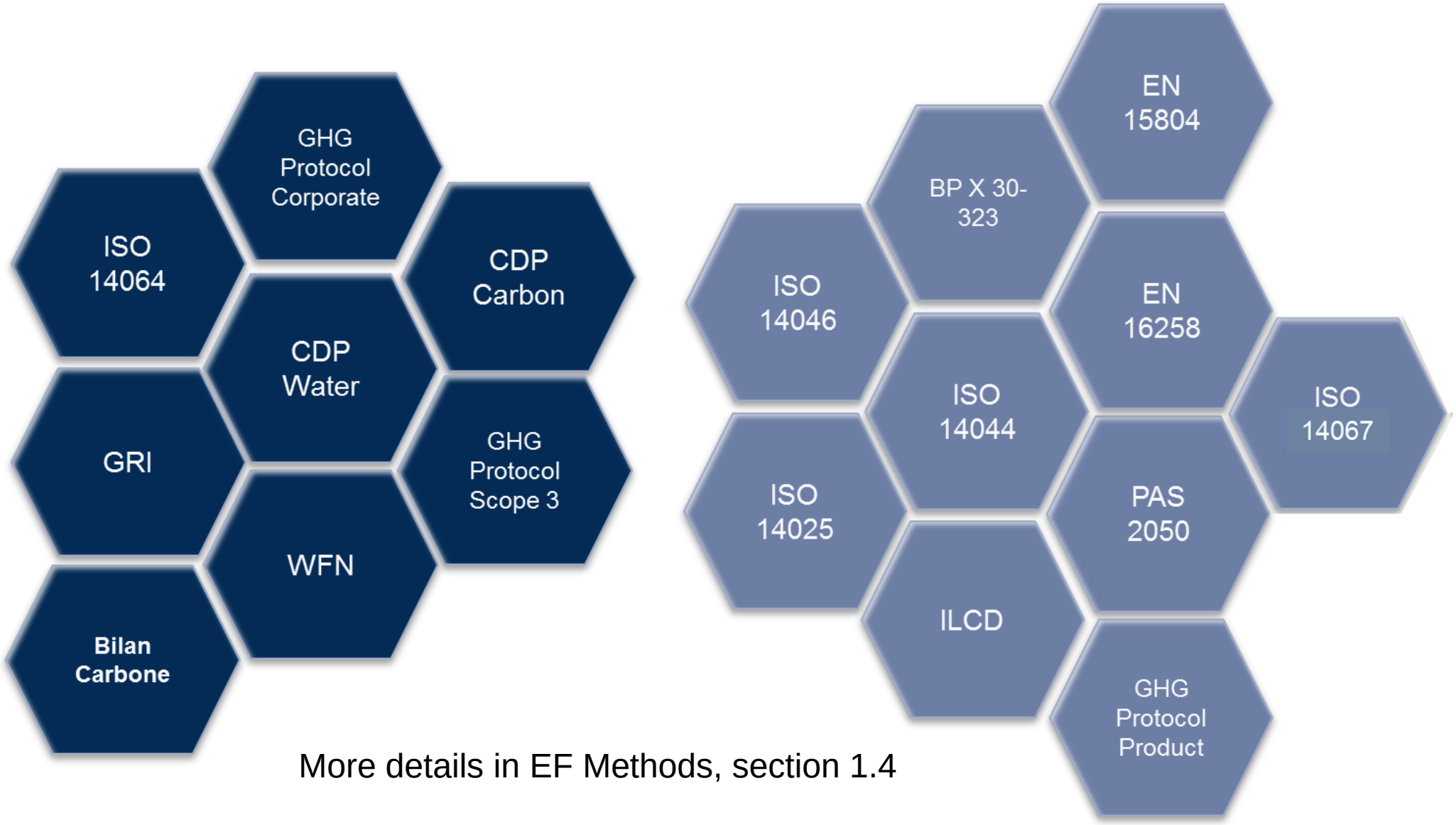
- Any product or organisation on EU market
- Pilot Phase (2013-2018):
  - 280 organisations involved (industry associations, large OEM's)
  - ~3.000 stakeholders involved

16 impact categories

Impacts of the same category are summed up along the life cycle

Impacts categories are combined

Incorporation/consideration of existing standards



More details in EF Methods, section 1.4

Who knows the abbreviations?

Acronym	??
EF	
PEF	
OEF	
PEFCR	
OEFSR	
RP (PEF-RP)	
RO (OEF RO)	
ILCD	

What is a PEFCR / OEFSR?

Product Environmental Footprint Category Rule (PEFCR):

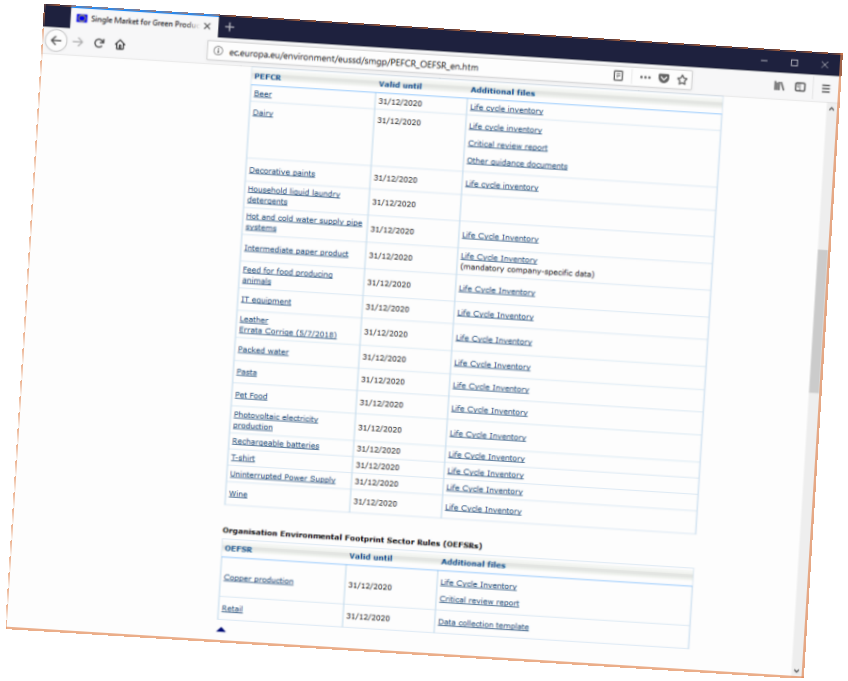
Consistent and specific set of rules to calculate the relevant environmental information of products belonging to the product category in scope.

Organisation Environmental Footprint Sector Rule (OEFSR):

Consistent and specific set of rules to calculate the relevant environmental information of the organisations belonging to the sector in scope.

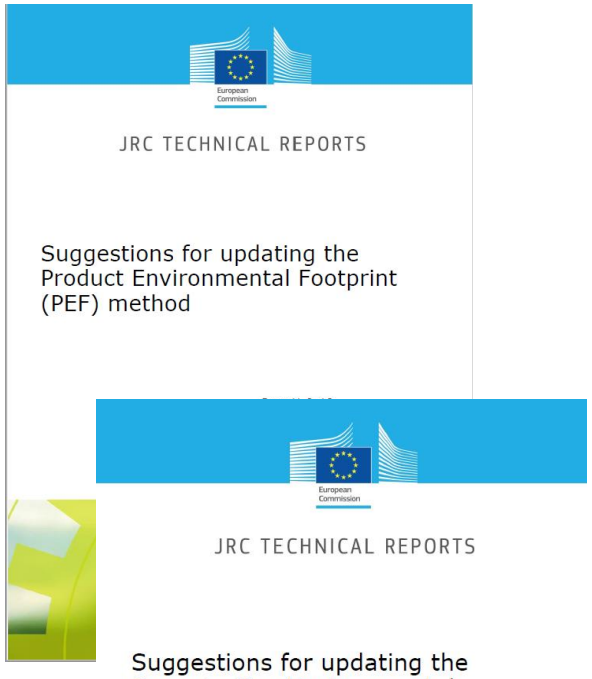
Published PEFCRs and OEFSRs

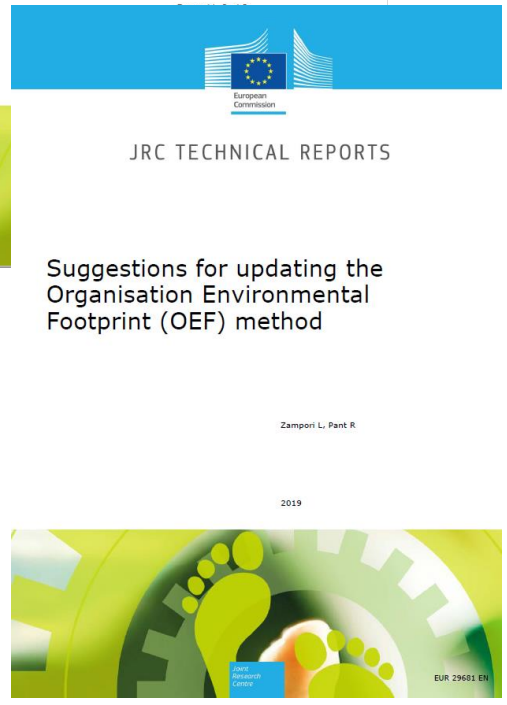
- OEFSRs:
  - Copper production
  - Retail
- PEFCRs:
  - Beer
  - Dairy
  - Decorative paints
  - Household liquid laundry detergents
  - Hot and cold water supply pipe systems
  - Intermediate paper product
  - Thermal insulation
  - Metal sheets
  - Feed for food producing animals
  - IT equipment
  - Leather
  - Packed water
  - Pasta
  - Pet food
  - Photovoltaic electricity production
  - Rechargeable batteries
  - T-shirt
  - Uninterruptible Power Supply
  - Wine



http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR_en.htm

The Product and Organisation Environmental Footprint Methods





- Published in March 2019 as one of the major outcomes of the Pilot Phase
- Based on the integration of Rec 179/2013 and of the PEFCR Guidance 6.3.
- Based on the original EF Guides developed as a major building blocks of the Flagship initiative of the Europe 2020 Strategy – “A Resource-Efficient Europe”
- Intended as detailed stand alone methods
- Based on life cycle approach (ILCD Handbook)
- As much as possible in line with existing approaches
- Have a product-category (PEFCR) / sector based approach (OEFSRs)
- Reproducibility shall be given priority over flexibility

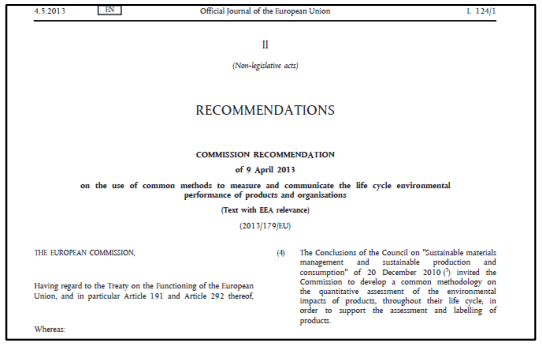
The two methods deliver a framework for product group specific and sector specific reporting requirements.

EF work: relevant documents

Pilot phase

Transition phase

2013 → **2018** → **2019-21**



4.5.2013 EN Official Journal of the European Union L 124/1

II

(Non-legislative acts)

RECOMMENDATIONS

COMMISSION RECOMMENDATION
of 9 April 2013
on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations
(Text with EEA relevance)
(2013/179/EU)

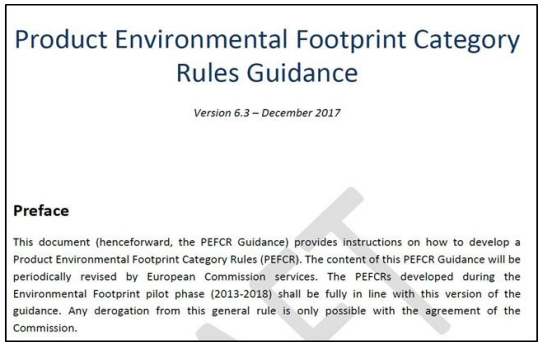
THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 191 and Article 292 thereof,

Whereas:

(4) The Conclusions of the Council on "Sustainable materials management and sustainable production and consumption" of 20 December 2010 (7) invited the Commission to develop a common methodology on the quantitative assessment of the environmental impacts of products, throughout their life cycle, in order to support the assessment and labelling of products.

Rec 179/2013



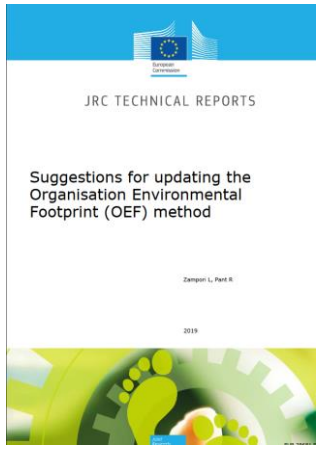
Product Environmental Footprint Category Rules Guidance

Version 6.3 – December 2017

Preface

This document (henceforward, the PEFCR Guidance) provides instructions on how to develop a Product Environmental Footprint Category Rules (PEFCR). The content of this PEFCR Guidance will be periodically revised by European Commission services. The PEFCRs developed during the Environmental Footprint pilot phase (2013-2018) 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.

PEFCR Guidance 6.3

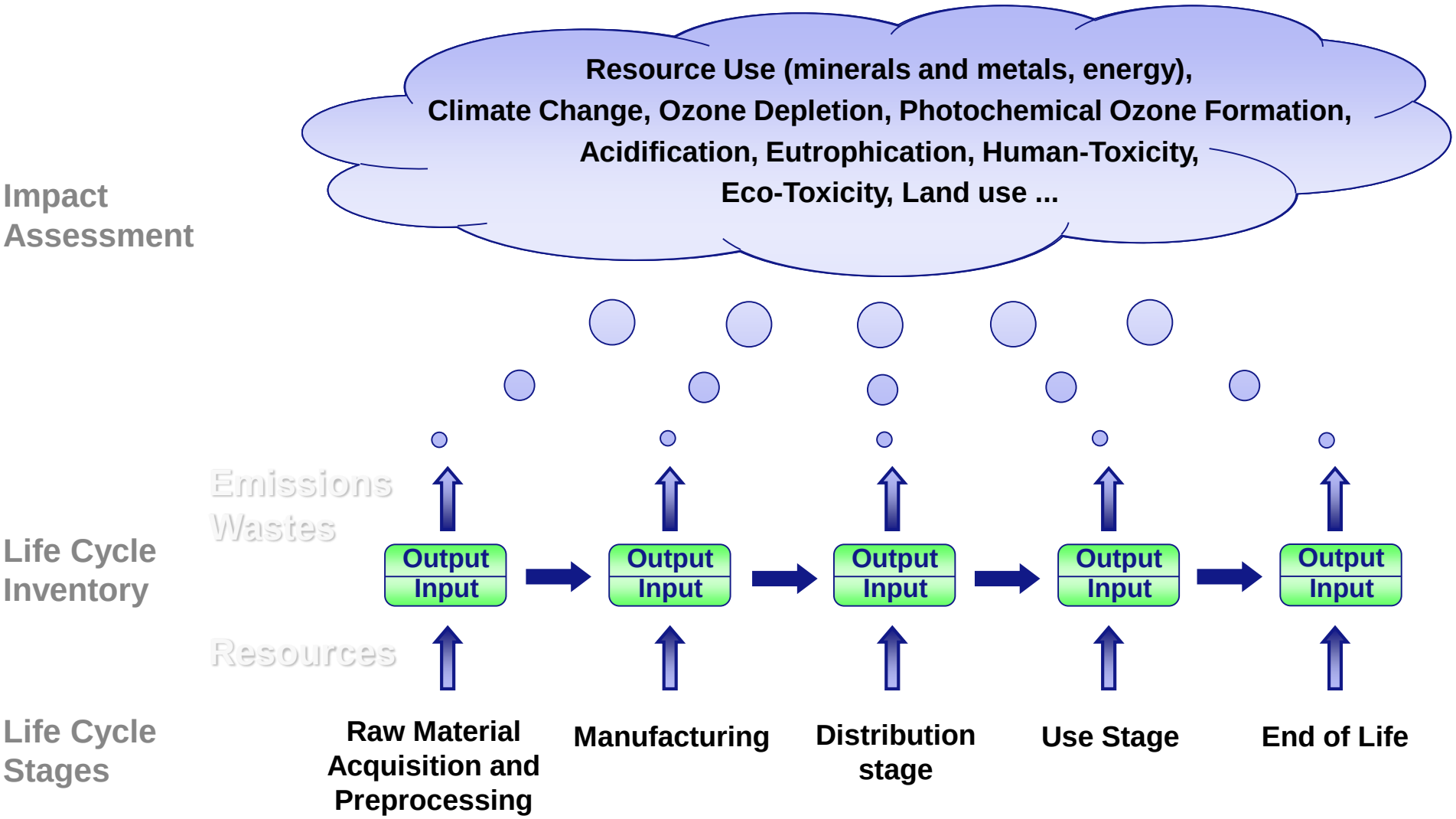


JRC TECHNICAL REPORTS

Suggestions for updating the Organisation Environmental Footprint (OEF) method

JRC tech report

...'based on a life cycle approach'... Life Cycle Assessment –



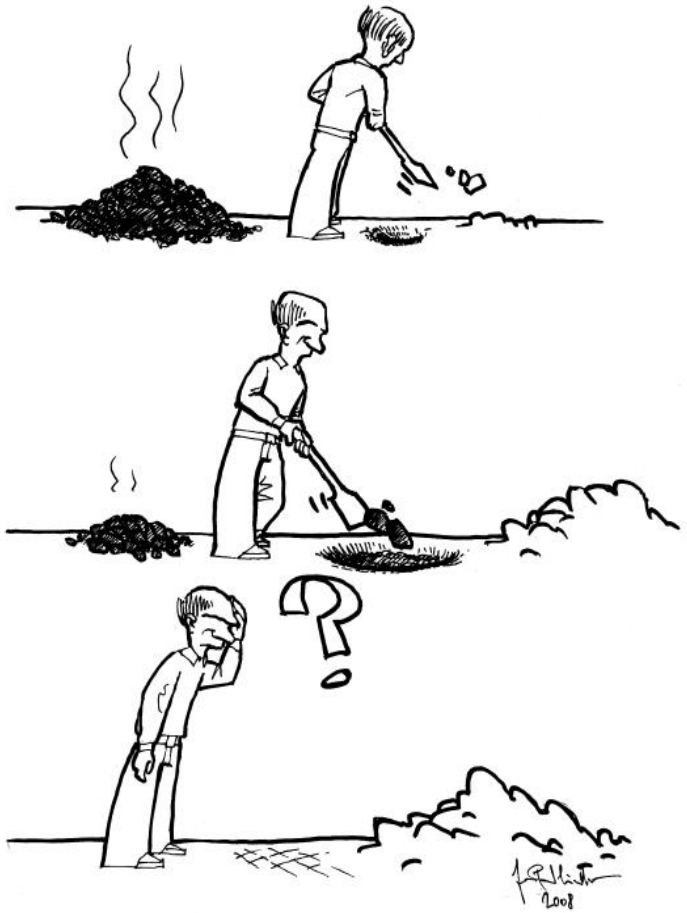
LCA/EF – understanding the trade-offs

Avoid...

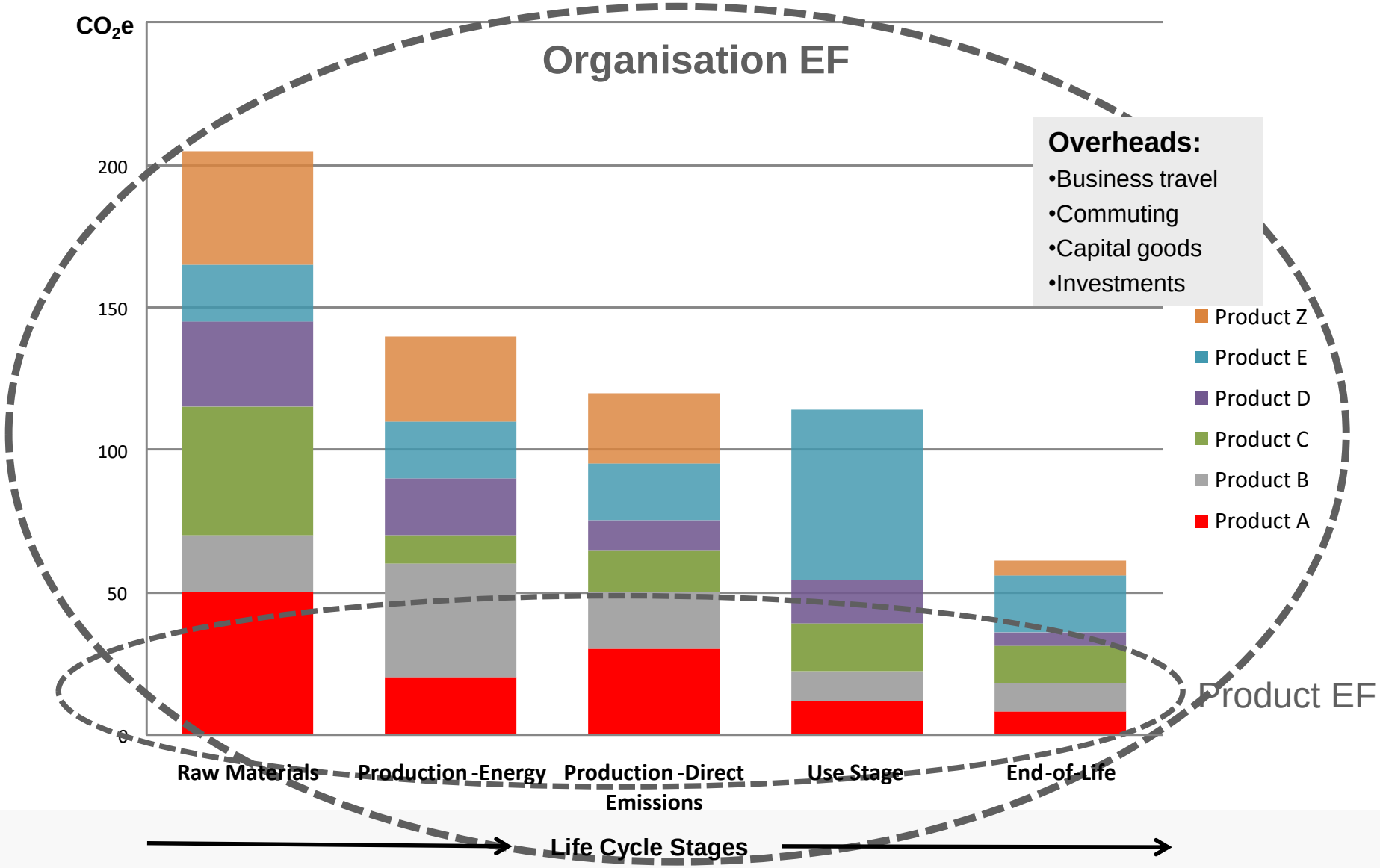
...solving a problem...

... by creating

a new problem.



Convergence of product and organisation footprint



Organisation Environmental Footprint: System Boundaries

Requirements for OEF studies:

The system boundaries shall include both

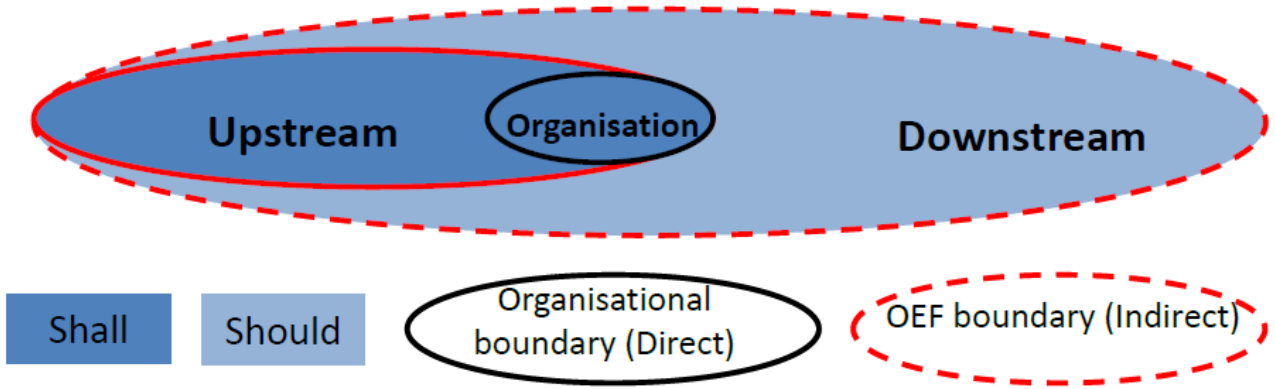
- Organisational boundaries (direct)
  - “The scope section of the OEFSR shall contain a description of the Product Portfolio and provide the NACE codes applicable to the sector in scope. The OEFSR shall specify the processes to be included in the organisational boundaries (direct activities).“
- Organisation Environmental Footprint Boundaries (indirect)
  - It shall also specify the OEF boundary, including specification of the supply chain stages to be included and all the indirect (upstream and downstream) activities, and give justification if downstream (indirect) activities are excluded (e.g. use stage of intermediate products or products with an undeterminable fate included in the product portfolio).

Organisation Environmental Footprint: System Boundaries

Requirements for OEF studies:

The system boundaries shall include both

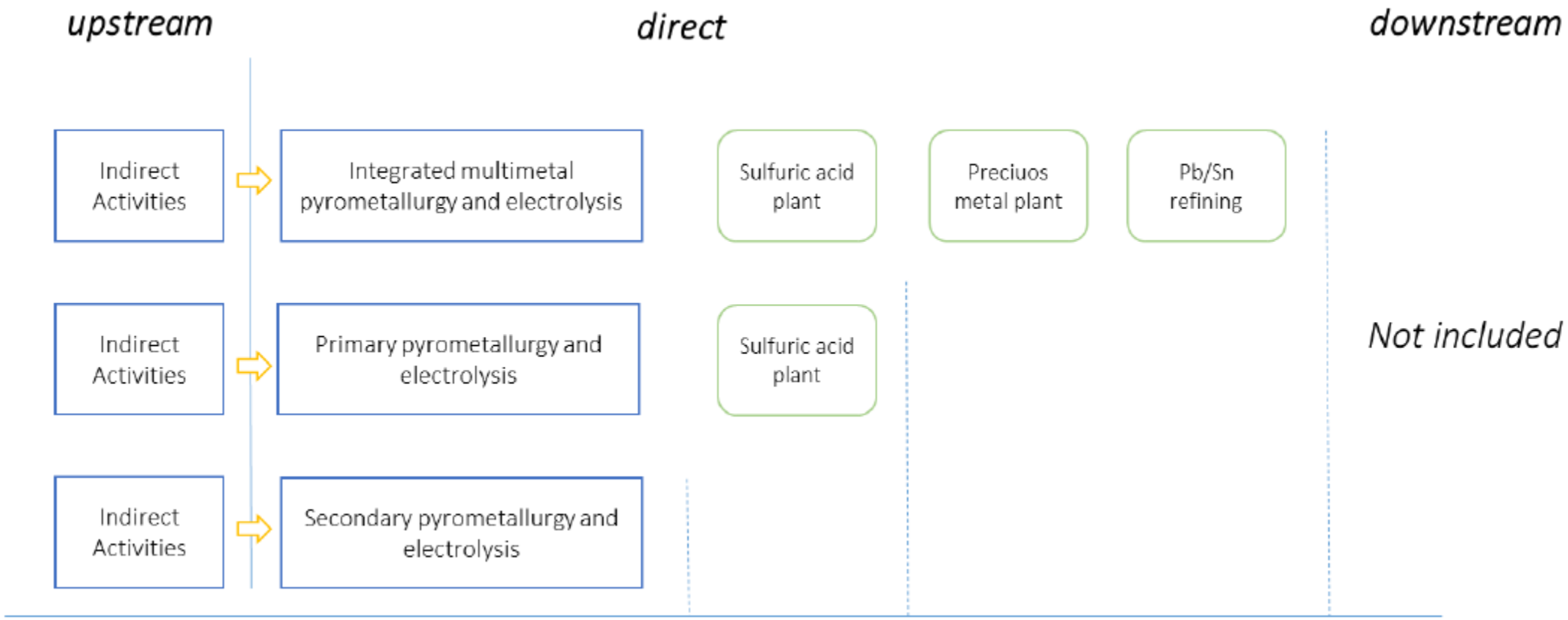
- Organisational boundaries (direct)
- Organisation Environmental Footprint Boundaries (indirect)



Mandatory and optional processes/activities to be distinguished for OEF studies

Organisation Environmental Footprint: System Boundaries

Example [Copper OEFSR]



Developments from LCA to EF

Overview

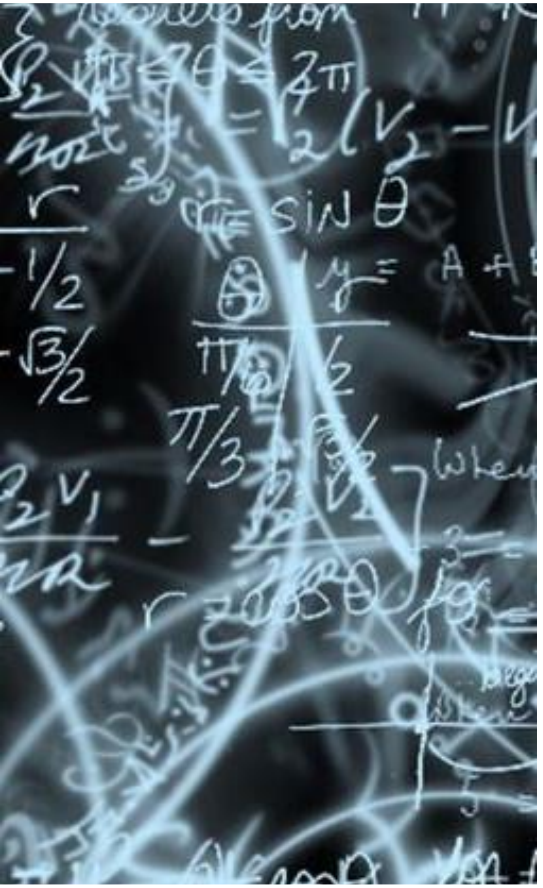
Official definition:

The Environmental Footprint (EF) is a life cycle assessment (LCA) based method to quantify the environmental impacts of products (goods or services). It builds on existing approaches and international standards.

Simple way:

- EF is the ‘next level of LCA’ where
- the method has been refined; and
- rules are being developed for *product groups (PEF)* and *industry sectors (OEF)*

LCA and EF – in other words…



PEF is a way of doing an LCA which enables to deliver more consistent, reliable, reproducible and verifiable results. Moreover, compared to a traditional ISO 14040 compliant LCA, PEF includes features that make easier the communication of its results both in B2B and B2C.

These new characteristics of PEF are possible due to:

- Provision of detailed methodological requirements,
- More stringent requirements related to data quality, and
- the introduction of normalization and weighting

Some developments from LCA to EF

Inventory

Issue	Practice until now	EF Methods
End of Life	Various options possible (ISO 14044)	”Circular footprint formula” to calculate recycling situations, energy recovery and landfill
Electricity	Upstream: Preference for supplier-specific data - if not included in grid mix, otherwise regional grid mix (GHGP[1)] p. 52) Downstream: Use of national grid mixes	Upstream: preference to supplier-specific data Downstream: national grid mixes according to location of use.
Cut-off	Only permitted “if it does not significantly change the overall conclusions of the study”. Exclusions must be based on material flows, energy flows and environmental significance (ISO 14044)	“Shall be avoided” but up to 3.0% (in total) may be excluded, based on material flows, energy flows and environmental significance
Capital goods	Companies are not required to include non-attributable processes. If included, companies shall disclose this in the inventory report. (GHGP)	Capital goods (including infrastructures) and their end of life should be excluded, unless there is evidence from previous studies that they are relevant
Data Quality Indicators	Data quality to be reported in comparative assertions (ISO). Data quality to be reported (GHGP)	DQR’s to be determined and reported.[1)]

[1)] GHG Protocol (2011): Product Life Cycle Accounting Standard

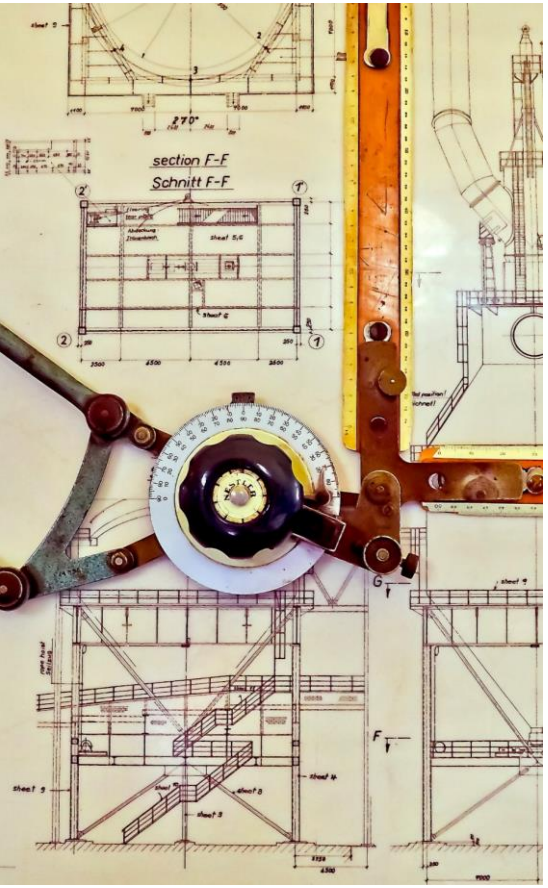
[1)] For more details and Data Needs Matrix see section Data Requirements

Developments from LCA to EF

Impact Assessment

Issue	ISO 14044	EF Method
Impact Assessment Categories	No default impact categories defined.	Default list of 16 impact categories which must be included
Impact Assessment Methods	No specification (other than description if classification and characterization)	Each IC has its own recommended method (based on the ILCD handbook as a start) and specific CF's
Normalisation	Optional	Compulsory
Weighting	Optional	Compulsory
Additional Environmental Information	Not required	Consider and report them "whenever feasible". Biodiversity should be addressed separately.

Principles



To produce reliable, reproducible, and verifiable EF studies, a core suite of analytical principles shall be adhered to:

(1) Relevance

(2) Completeness

(3) Consistency

(4) Accuracy

(5) Transparency

Applications

In-house applications

- optimisation of processes along the life cycle of a product,
- support to environmental management,
- identification of environmental hotspots,
- support for product design minimising environmental impacts along the life cycle,
- environmental performance improvement and tracking,

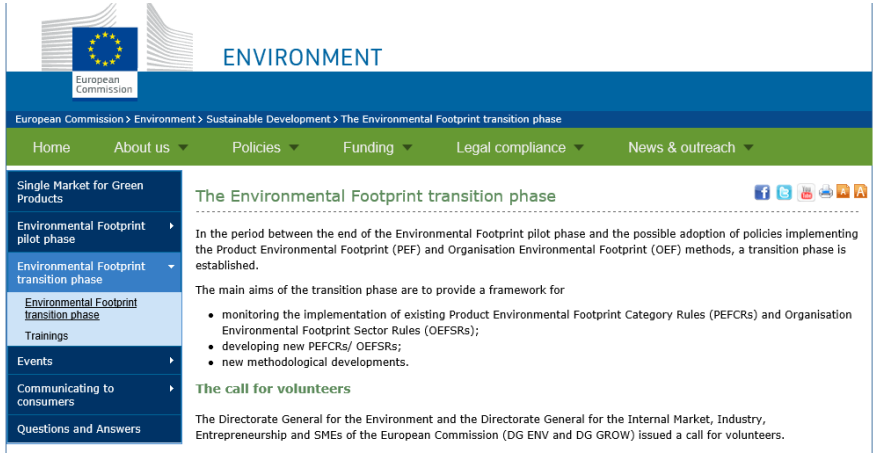
External applications (B2B, B2C)

- responding to customers and consumers demands,
- marketing,
- co-operation along supply chains to optimise the product life cycle,
- participation in 3rd party schemes related to environmental claims or giving visibility to products that communicate their life cycle environmental performance.

Additional applications if in compliance with a PEFCR/OEFSR

- Comparisons and comparative assertions (i.e. claims of overall superiority or equivalence of the environmental performance of one product compared to another),
- Comparison and comparative assertions against the benchmark followed by a grading of other products/organisations according to their performance versus the benchmark,
- Identification of significant environmental impacts common to a product group/sector,
- Reputational schemes giving visibility to products/organisations that calculate their life cycle environmental performance,
- Green procurement (public and corporate).

Relevant links and content

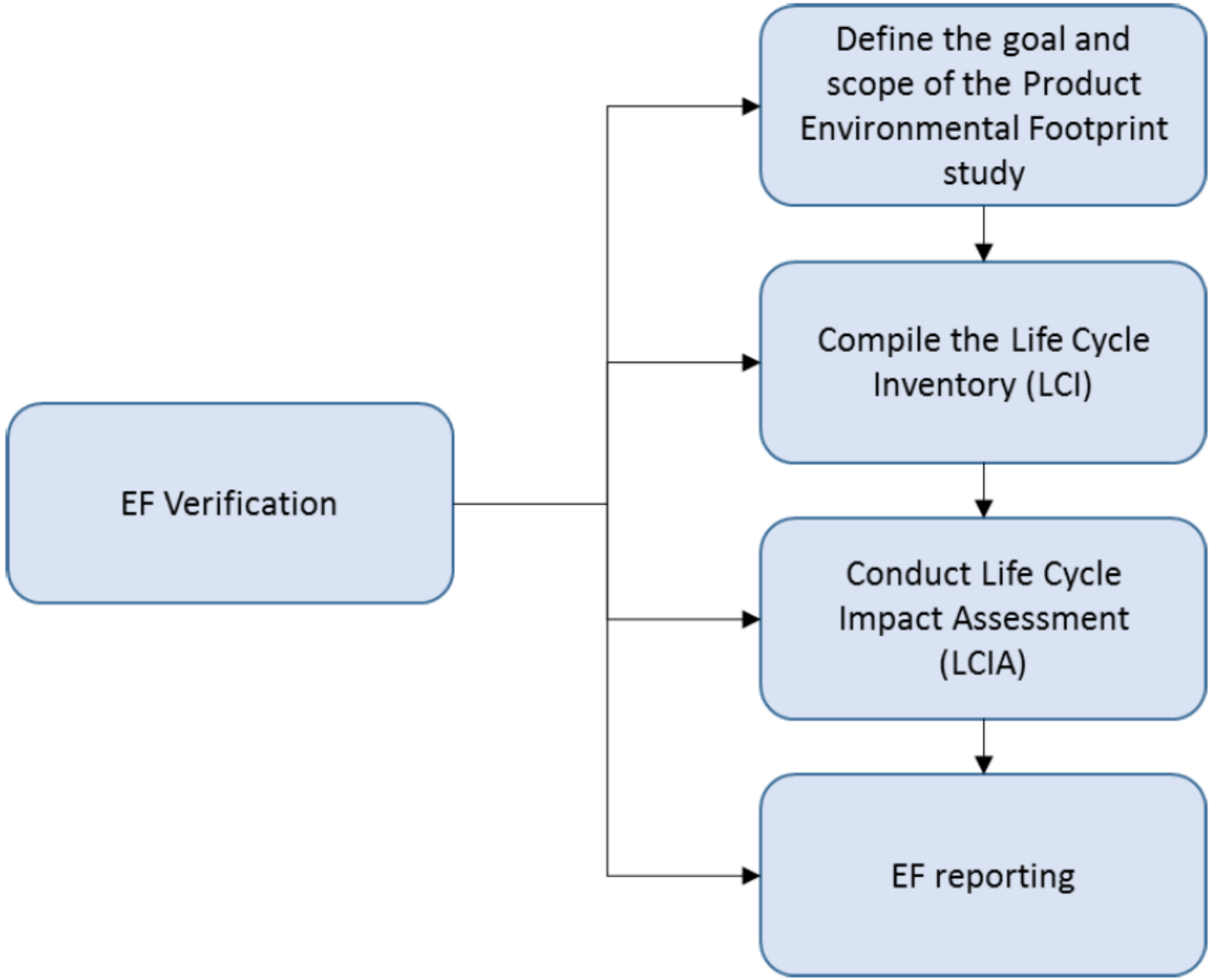


[DG ENVIRONMENT – EF Footprint Initiative]

[European Platform on Life Cycle Assessment (EPLCA) by JRC]

Getting ready

Phases of an EF study



Goal

The goal of a **PEF/OEF** states:

- the intended application,
- the reasons for carrying out the study,
- the intended audience, i.e. to whom the results of the study are intended to be communicated,
- commissioner of the study, and
- identity of the verifier.

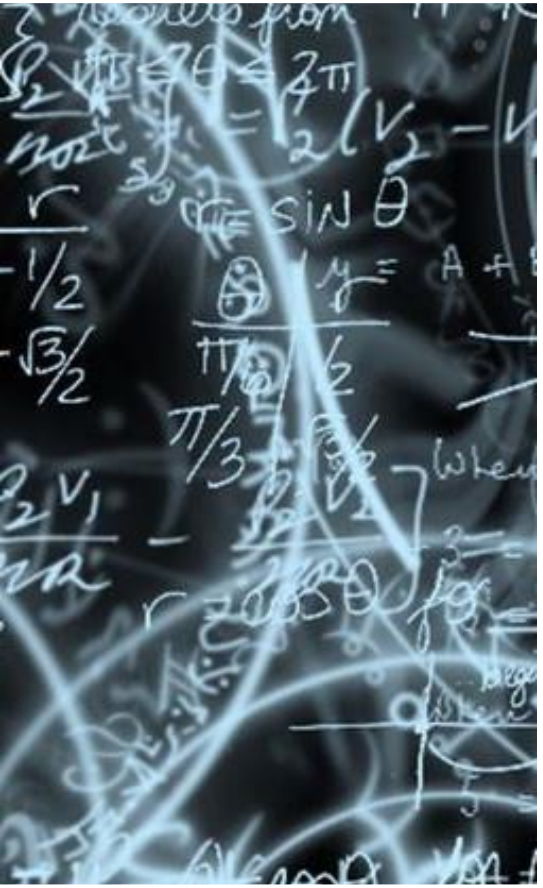
Goal

The intended application of the study describes how the study's results are to be used. Some of the common uses are:

- Identify environmental "hot spots" in a product's life cycle
- Guide product development (e.g., inform green design decisions)
- Support product certifications, labeling etc.
- Support public policy decisions
- *Benchmark against an average (only if done under a PEFCR)*
- *Compare different products (only if done under a PEFCR)*

The purpose of the study describes the drivers and motivations of the LCA, including the specific decisions that the study is designed to support. **The intended audience** describes who will use the LCA.

Outcomes of an EF study (1)

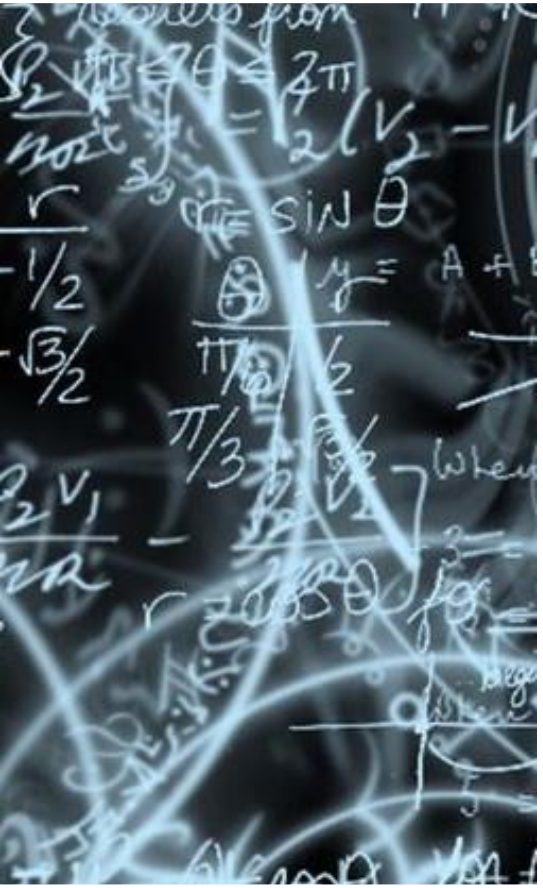


Environmental profile

Hotspot results

Additional information

Outcomes of a PEF study (2)



The environmental performance of the product, using all the EF impact categories and models.

Results of a PEF study shall be calculated and reported in the EF report as

- characterised,
- normalised, and
- weighted results for each EF impact category; and
- as a single overall score based on the weighting factors and associated report

Results shall be reported for

- *the total life cycle, and*
- *the total life cycle excluding the use stage.*

Outcomes of an **OEF** study

The environmental performance of the organisation, using all the EF impact categories and models.

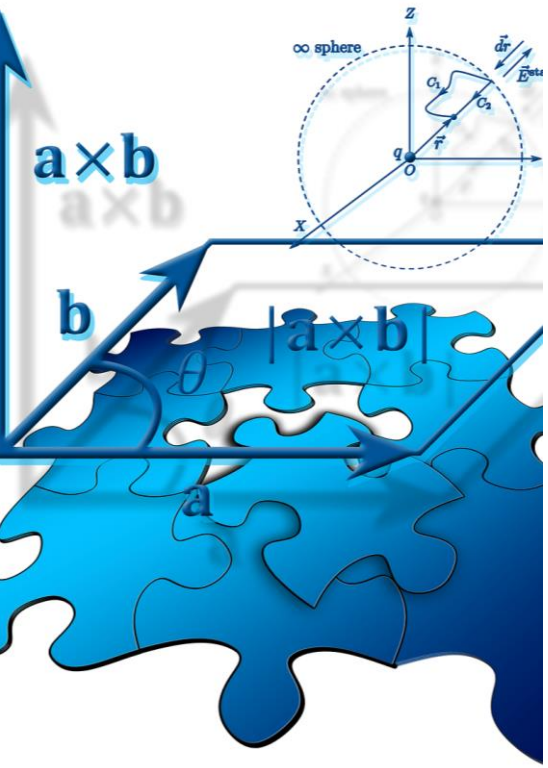
Results of a OEF study shall be calculated and reported in the EF report as

- characterised,
- normalised, and
- weighted results for each EF impact category; and
- as a single overall score based on the weighting factors and associated report

Results shall be reported for the total life cycle

Note: In scope definition, justification to be given if downstream (indirect) activities are excluded

Scope



The scope of the EF study describes in detail the system to be evaluated and the technical specifications.

The scope definition shall be in line with the defined goals of the study and shall include (see subsequent sections for a more detailed description):

- **Functional unit and reference flow;**
- **System boundary;**
- **EF impact categories;**
- **Additional information to be included;**
- **Assumptions/Limitations.**

Functional Unit and Reference Flow

Functional unit:

Quantified performance of a product system for use as a reference unit

Reference flow:

The amount of product needed to provide the defined function

Functional Unit

A product without a function is useless

Function

What?

Unit & magnitude

How much?

Duration

How long?

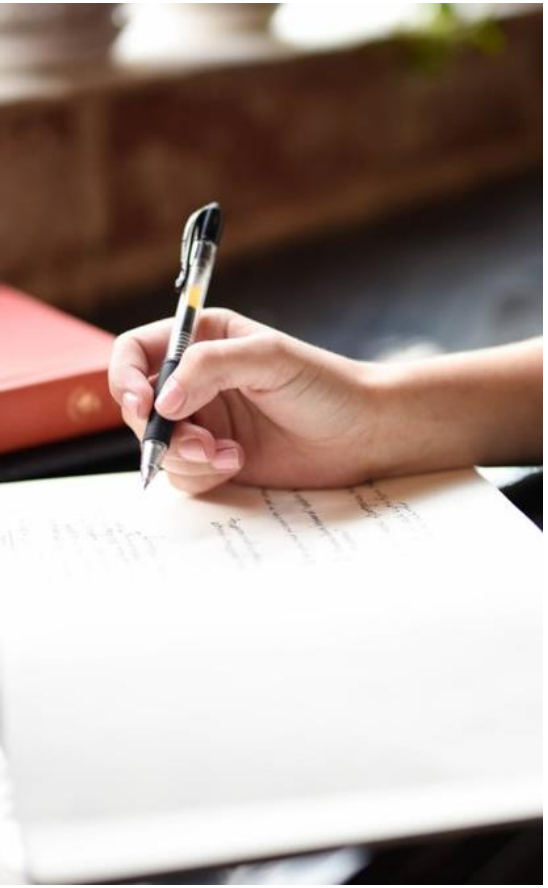
Level of quality

How well?

Functional Unit

- Function: to color and protect a surface.
- Functional Unit: cover 10 square meters for 10 years.
- Reference flow: one liter (high quality paint)

Function, Functional Unit & Reference Flow



Function

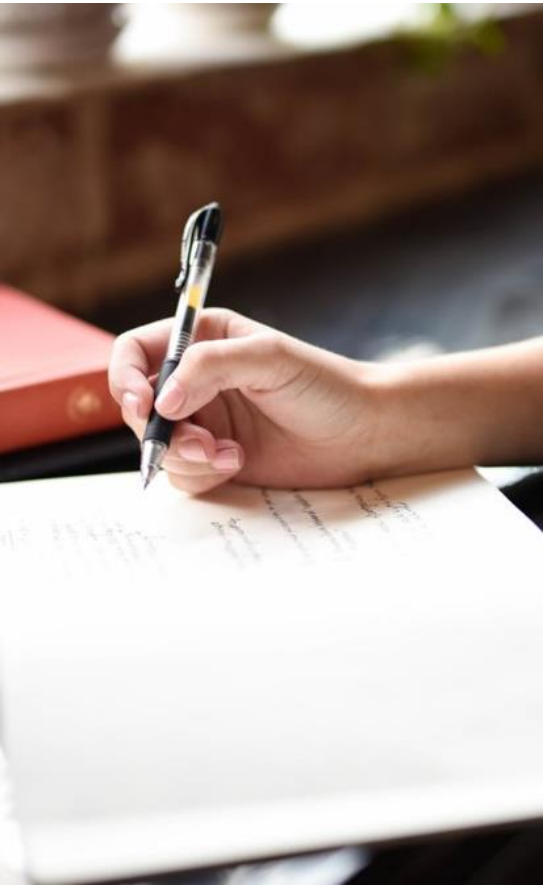
The useful service provided by the product

Functional unit (FU)

The quantified performance of a product system, to be used as a reference unit. The functional unit qualitatively and quantitatively describes the function(s) and duration of the product in scope.

Functional unit is to quantify the identified functions in a more precise way that facilitates mathematical analysis. For example, a functional unit for paint might be to "cover 10 square meters for 10 years." It is important for the functional unit to be both precise and measurable, because it serves as the reference to which the inputs and outputs of our life-cycle system are normalized. ***The functional unit*** *also allows for credible comparisons of different product options on the basis of providing an equivalent service.*

Function, Functional Unit & Reference Flow



Note from previous slide – part II

Finally, **the reference flow** is the amount of a product(s) required to fulfil the function. For example, to cover 10 square meters for 10 years. The reference flow for high quality paint is one liter per functional unit. Without the reference flow, we wouldn't know how much paint makes sense to analyse in our LCA.

Only by comparing reference flows on the basis of a functional unit can we properly compare the impacts of different products in an LCA. E.g. if we would consider a lower quality paint that lasts only half the time, we have to take 2 liters of that paint to have a comparable function. Had we not defined the functional unit and reference flow carefully we would have made a mistake and compared 1 kg of high quality paint to 1 kg of low quality paint.

Example Pet Food

What: To serve the recommended daily intake in kilocalories of metabolizable energy (kcal ME) (“daily ration”) of prepared pet food to a cat or dog,

How much: Daily ration

How well: To meet the daily caloric and nutritional requirements of an average cat or dog (where average refers to the pet weight: 4 kg for a cat and 15 kg for a dog)

How long: 1 day of serving prepared pet food to a cat or dog.

Reference flow: Amount of product needed to fulfil the defined function and shall be measured in grams (g) per day.

Function, Functional Unit & Reference Flow

Please define reference flow for each product to enable a comparison…

Impact categories (1)

Impact category	Impact category Indicator	Unit	Characterization model	Robustness
Climate change, total [1)]	Radiative forcing as global warming potential (GWP100)	kg $CO_{2\ eq}$	Baseline model of 100 years of the IPCC (based on IPCC 2013)	I
Ozone depletion	Ozone Depletion Potential (ODP)	kg CFC-11 eq	Steady-state ODPs as in (WMO 2014 + integrations)	I
Human toxicity, cancer [2)]	Comparative Toxic Unit for humans (CTU_h)	CTUh	USEtox model 2.1 (Fankte et al, 2017)	III
Human toxicity, non-cancer [2)]	Comparative Toxic Unit for humans (CTU_h)	CTUh	USEtox model 2.1 (Fankte et al, 2017)	III
Particulate matter	Impact on human health	disease incidence	PM method recomended by UNEP (UNEP 2016)	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)	II
Photochemical ozone formation, human health	Tropospheric ozone concentration increase	kg NMVOC eq	LOTOS-EUROS model (Van Zelm et al, 2008) as implemented in ReCiPe 2008	II
Acidification	Accumulated Exceedance (AE)	mol H+ eq	Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)	II

[1)] The indicator “Climate Change, total” is constituted by three sub-indicators:
Climate Change, fossil; Climate Change, biogenic; Climate Change, land use and land use change.

Impact categories (2)

Impact category	Impact category Indicator	Unit	Characterization model	Robustness
Eutrophication, terrestrial	Accumulated Exceedance (AE)	mol N eq	Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)	II
Eutrophication, freshwater	Fraction of nutrients reaching freshwater end compartment (P)	kg P eq	EUTREND model (Struijs et al, 2009) as implemented in ReCiPe	II
Eutrophication, marine	Fraction of nutrients reaching marine end compartment (N)	kg N eq	EUTREND model (Struijs et al, 2009) as implemented in ReCiPe	II
Ecotoxicity, freshwater [2)]	Comparative Toxic Unit for ecosystems (CTU_e)	CTUe	USEtox model 2.1 (Fankte et al, 2017)	III
Land use	Soil quality index [3)] Biotic production Erosion resistance Mechanical filtration Groundwater replenishment	Dimensionless (pt) kg biotic production kg soil m3 water m3 groundwater	Soil quality index based on LANCA (Beck et al. 2010 and Bos et al. 2016)	III
Water use	User deprivation potential (deprivation-weighted water consumption)	m3 world eq	Available WAter REmaining (AWARE) as recommended by UNEP, 2016	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)26	MJ	CML 2002 (Guinée et al., 2002) and van Oers et al. 2002	III

[2)] Toxicity indiators also have three subindicators but only the sum of the three shall be reported
[3)] This index is the result of the aggregation, performed by JRC, of the 4 indicators provided by LANCA model as indicators for land use.

Impact Assessment - Classification

Selection of impact categories, category indicators and characterization models

Classification: Assignment of LCI results to impact categories

Characterization: Calculation of category indicator results

Category indicator results (LCIA profile)

Normalization of category indicator results relative to reference information

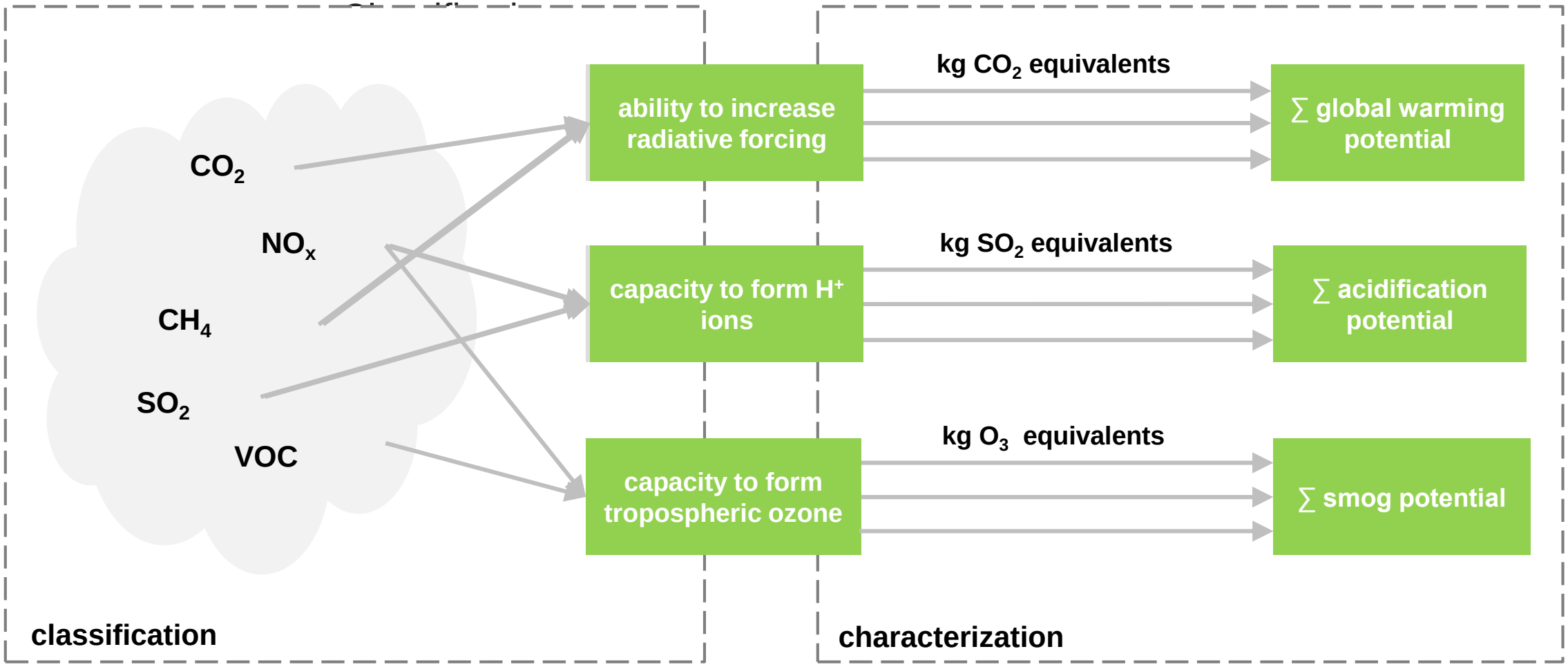
Grouping

Weighting

Note difference to ISO: Mandatory for EF, optional for ISO

For details, see EF Reference Package

Impact Assessment



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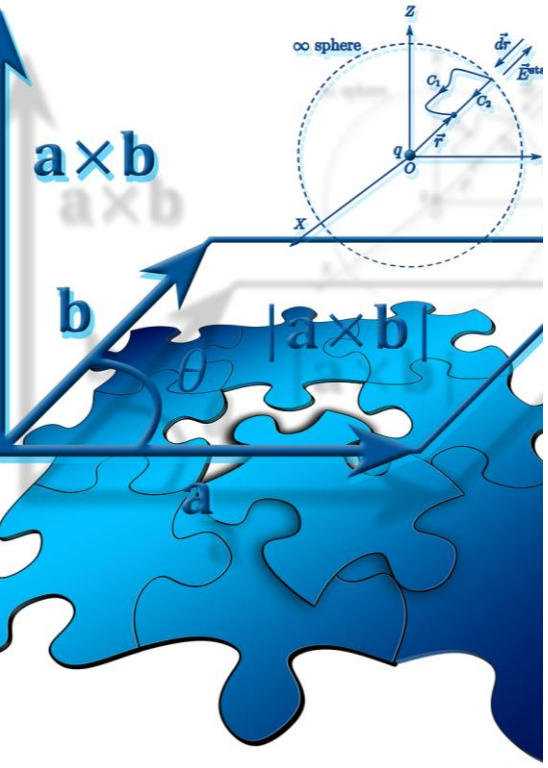
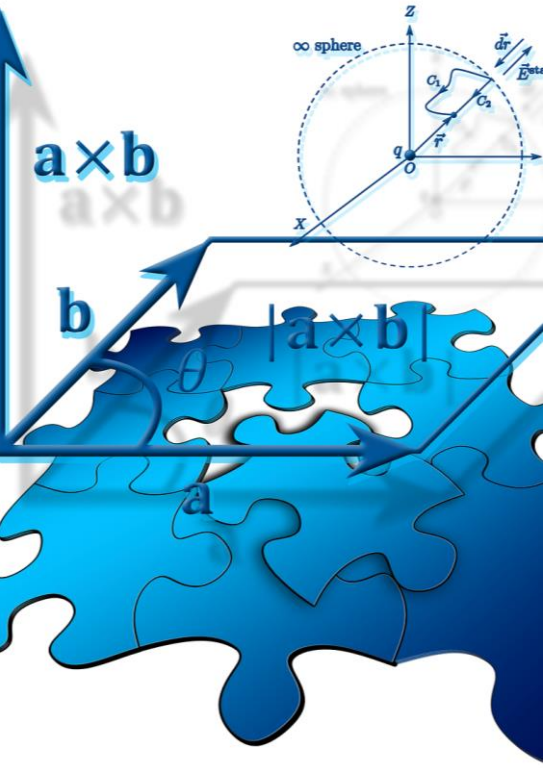
Additional information



- Relevant (additional) potential **environmental impacts** of a product
  - Maybe beyond EF impact categories
  - Consider and report whenever feasible
  - Additional environmental information shall be:
    - Based on information that is substantiated and has been reviewed or verified
    - Specific, accurate and not misleading;
    - Relevant to the particular product category;
    - Life cycle based information additional to the EF impact categories
- Relevant **technical aspects** and/or physical properties
  - Shall be reported

.

Additional environmental information may include



(a) Information on local/site-specific impacts;

(b) Offsets;

(c) Environmental indicators or product responsibility indicators (as per the Global Reporting Initiative (GRI));

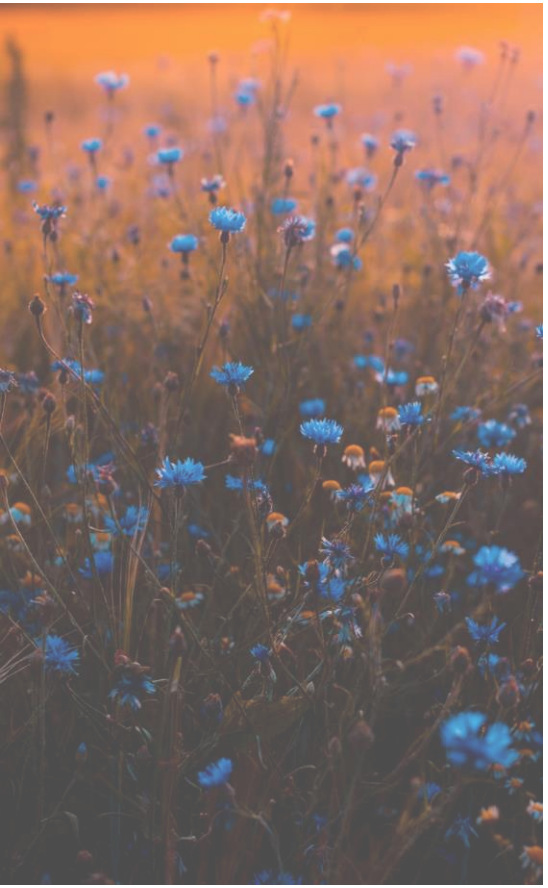
(d) For gate-to-gate assessments, number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk;

(e) Description of significant impacts of activities, products, and services on biodiversity in protected areas and in areas of high biodiversity value outside protected areas;

(f) Noise impacts;

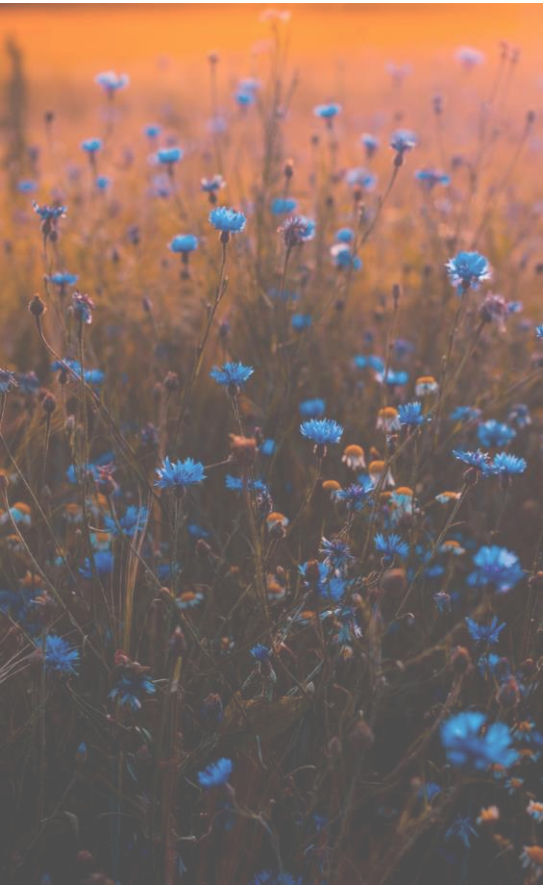
(g) Other environmental information considered relevant within the scope of the EF study.

Biodiversity



- Currently no impact category named “biodiversity”
- But at least eight impact categories have an effect on biodiversity:
  - Climate change, Eutrophication aquatic freshwater, eutrophication aquatic marine, eutrophication terrestrial, acidification, water use, land use, ecotoxicity freshwater
- Biodiversity **should** be addressed separately
- Each study **shall** explain whether biodiversity is relevant
- If yes, biodiversity indicators **shall** be included under additional environmental information

Biodiversity coverage (suggestions)



- 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
- Report additionally the percentage of such materials for which no chain of custody or traceability information can be found.
- Use a certification system as a proxy. A useful overview of standards is available on http://www.standardsmap.org/

Additional technical information may include (non-exhaustive)

(a) Bill of materials data;

(b) Dismantleability, reparability and other circular economy related information;

(c) Information on the use of hazardous substances;

(d) Information on the disposal of hazardous/non-hazardous waste;

(e) Information on energy consumption;

(f) Technical parameters, such as the use of renewable versus non-renewable energy, the use of renewable versus non-renewable fuels, the use of secondary materials, the use of fresh water resources;

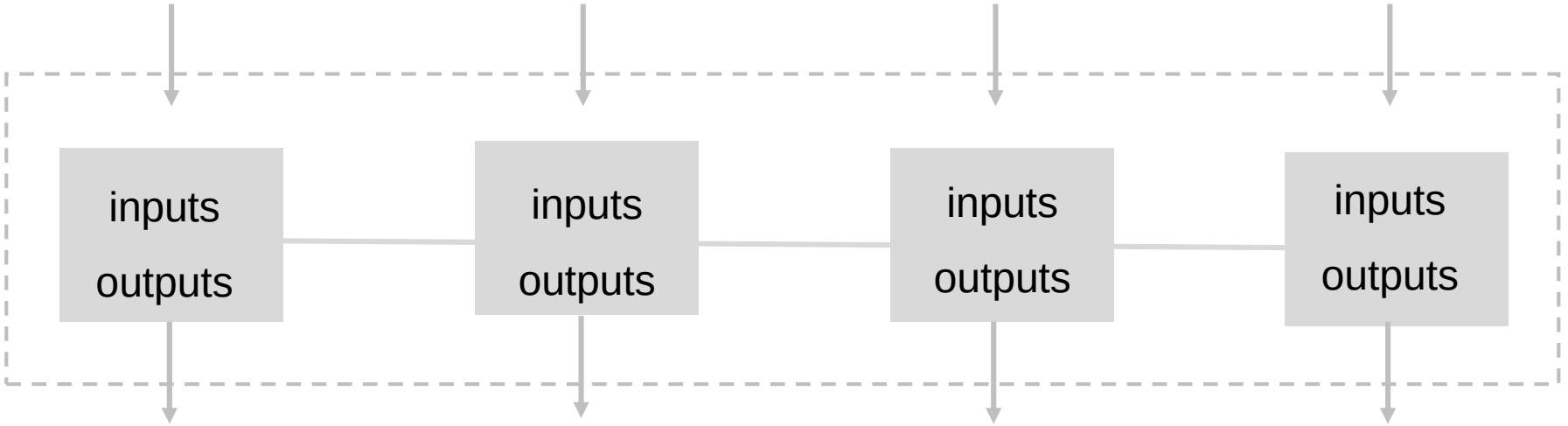
(g) Total weight of waste by type and disposal method;

(h) Weight of transported, imported, exported, or treated waste deemed hazardous under the terms of the Basel Convention Annexes I, II, III, and VIII, and percentage of transported waste shipped internationally;

(i) Information and data related to the functional unit and technical performance of the product.

Life cycle inventory

EF Method: ‘An inventory of all material, energy and waste inputs and outputs and emissions into air, water and soil for the product supply chain shall be compiled as a basis for modelling the EF. This is called the life cycle inventory.’



ISO 14040: Inventory Analysis is a phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle).

LC inventory – screening step

- Highly recommended (helps focusing)
- Shall include the LCIA stage
- Refine the LC model in an iterative way
- No cut off allowed
- Readily available primary and secondary data may be used
- After screening, scope settings may be refined

Life cycle stages

Raw Materials
acquisition and pre-processing

Manufacturing
(production of the main product)

Distribution
(product distribution and storage)

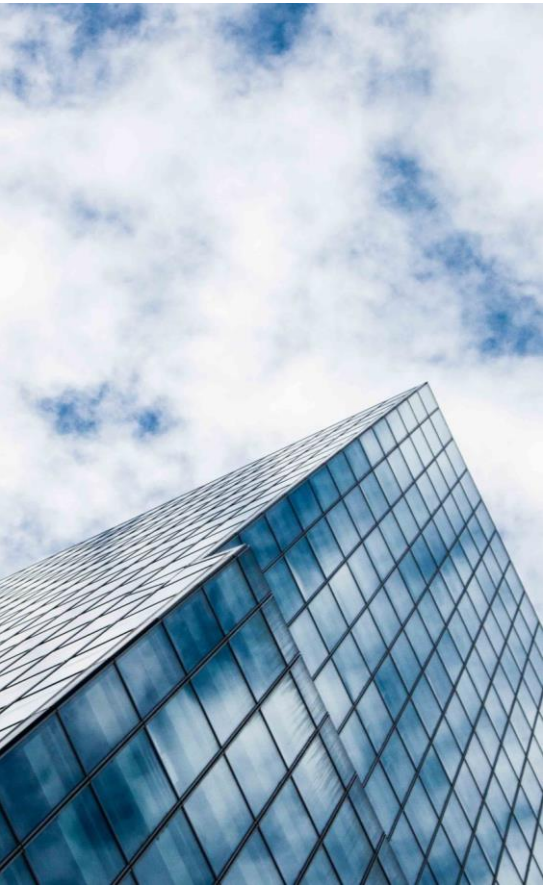
Use stage

End of life
(including product recovery or recycling)

- LCI shall be done according to these fixed LC stages (if justified, LCS may be added or split)
- For intermediate products, Use stage and EoL shall be excluded
- If naming of default LC stages is changed, the user shall specify which default life cycle stage it corresponds to

Modelling Requirements

Overview



- PEF/OEF Method gives detailed guidance on how to model specific life cycle stages, processes and other aspects.
- Aspects covered
  - Agricultural production;
  - Electricity use;
  - Transport and logistics;
  - Capital goods (infrastructure and equipment);
  - Storage at distribution center or retail;
  - Sampling procedure;
  - Use stage;
  - End of life modelling
  - Extended product lifetime;
  - Packaging;
  - Greenhouse gas emissions and removals;
  - Offsets;
  - Handling multi-functional processes;
  - Data collection requirements and quality requirements[1)];
  - Cut-off

[1)] Separate session after lunch

Electricity use

- To be modelled as precisely as possible giving preference to supplier-specific data.
- Electricity mix to be used, in hierarchical order:
  a. **Supplier-specific electricity product** if for a country there is a 100% tracking system in place [1)]
  b. **The supplier-specific total electricity mix** [1)]
  c. **(The 'country-specific residual grid mix, consumption mix'** shall be used. (Residual grid mix prevents double counting with the use of supplier-specific electricity mixes in (a) and (b)
  d. As a last option, the **average EU residual grid mix, consumption mix** (EU-28 +EFTA), or region representative residual grid mix, consumption mix, shall be used.

Note: Does not apply for the use stage. "For the use stage the consumption grid mix shall be used."

[1)] if available and the set of minimum criteria to ensure the contractual instruments are reliable is met.

Consumption and residual grid mix

- **Consumption grid mix**
  Total electricity mix transferred over a defined grid including green claimed or tracked electricity

- **Residual grid mix**
  Consumption mix (also named residual consumption mix), which characterizes the unclaimed, untracked or publicly shared electricity only.

Electricity use (supplier specific mix)

- Minimum criteria important to ensure environmental integrity, accuracy and consistency
- Set of minimum criteria to ensure contractual instruments from suppliers
  - Criterion 1: Convey environmental attributes and give explanation about the calculation method
  - Criterion 2: Be a unique claim
  - Criterion 3: Be as close as possible to the period to which the contractual instrument is applied

For details see Table 5 of PEF Method (p. 50 ff)

Electricity use (1)

How to model ‘country-specific residual grid mix, consumption mix’

- Datasets for residual grid mix, consumption mix, per energy type, per country and per voltage are made available by data providers
- If no dataset is available, use following approach:
  - Determine the country consumption mix (e.g. x% of MWh with hydro, …)
  - Combine 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 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).

Electricity use (2)

Electricity use at 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)
  - No data available: the average EU consumption mix (EU-28 +EFTA), or region-representative consumption mix, shall be used

Detailed guidance for the following cases also available:

- A single location with multiple products and more than one electricity mix
- For multiple locations producing one product

Transport and logistics (1)

Important parameters

- Transport type
- Vehicle type & fuel consumption
- Loading rate (=utilisation ratio)
- Number of empty returns
- Transport distance
- Fuel production (part of dataset)
- Infrastructure (part of dataset)
- Resources and tools (e.g. cranes, transporters)

Default scenarios are available if no specific data is available for transport :

- From supplier to factory;
- From factory to final client; and
- From EoL collection to EoL treatment

Note: Some primary data still required:

- *At least percentage of products transported to various destination types*
- *Tonnages or volumes*

Transport and logistics (2)

EF compliant datasets for truck transport are per tkm (tonne*km)

Transport payload indicated in dataset Transport emissions calculated on mass basis

In EF compliant datasets transport is modelled in a parametrized way through the **utilization ratio:**
kg real load divided by kg payload

Example: If truck is 'full' with 10t and has 22t payload, environmental impact for the full load is 10/22 of the total emissions of the volume limited truck

Empty return trips may be included (calculated in %)

PEF/OEF studies shall specify the utilisation ratio to be used for each truck transport modelled and clearly indicate whether the utilisation ratio includes empty return trips.

Transport and logistics (3)

Default scenarios shall be used if no specific data are available.

Default scenario *"Suppliers located in Europe"*:

Packaging (manufacturer to filler)

- 230 km by truck (>32 t, EURO 4); and
- 280 km by train (average freight train); and
- 360 km by ship (barge).

Empty bottles

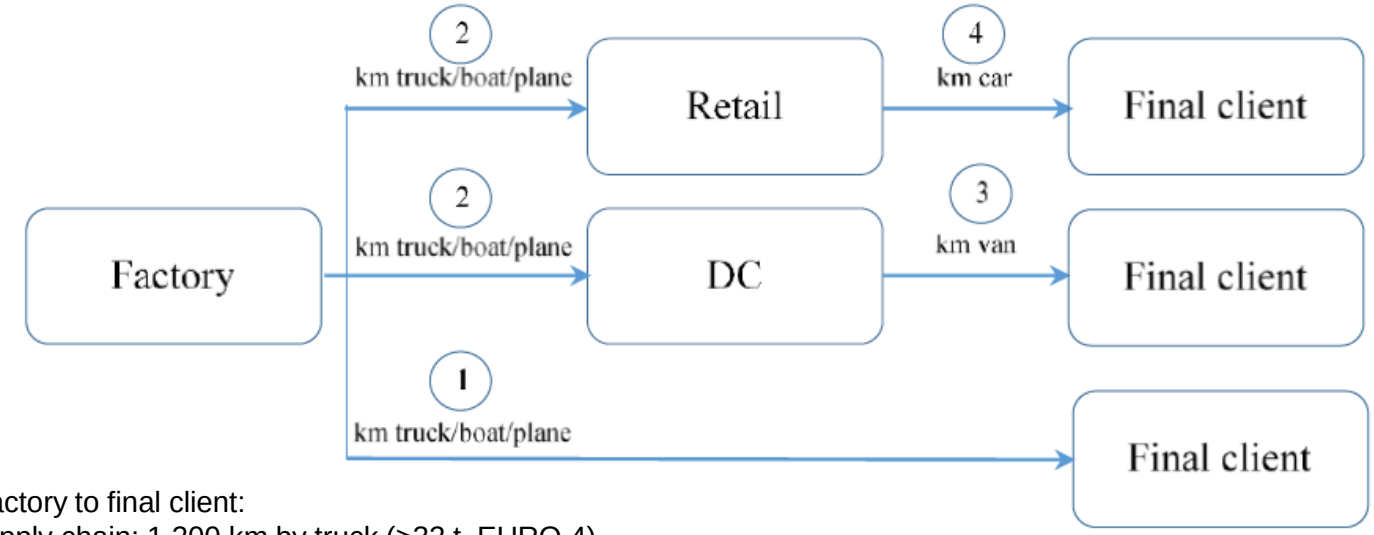
- 350 km by truck (>32 t, EURO 4); and
- 39 km by train (average freight train); and
- 87 km by ship (barge).

All other products

- 130 km by truck (>32 t, EURO 4); and
- 240 km by train (average freight train); and
- 270 km by ship (barge).

Transport and logistics (4)

Default scenario *“from factory to client”*:



(1) X% from factory to final client:
- **X%** local supply chain: 1,200 km by truck (>32 t, EURO 4)
- **X%** intracontinental supply chain: 3,500 km by truck (>32 t, EURO 4)
- **X%** international supply chain: 1,000 km by truck (>32 t, EURO 4) and 18'000 km by ship (transoceanic container).

(2) **X%** from factory to retail/ distribution centre (DC):
- **X%** local supply chain: 1,200 km by truck (>32 t, EURO 4).
- **X%** intracontinental supply chain: 3,500 km by truck (>32 t, EURO 4).
- **X%** international supply chain: 1,000 km truck (>32 t, EURO 4), and 18’000 km by ship (transoceanic container).

(3) **X%** from DC to final client:
- 100% Local: 250 km round trip by van (lorry <7.5t, EURO 3, utilisation ratio of 20%).

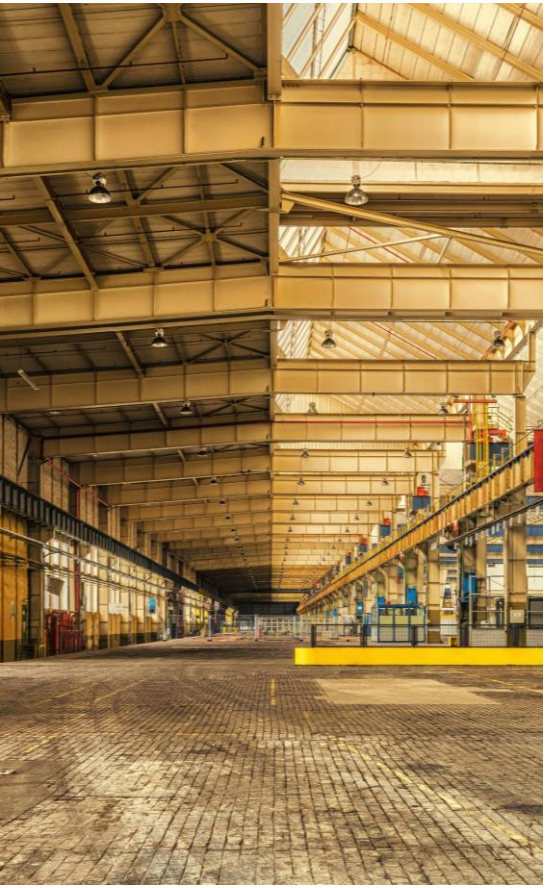
(4) **X%** from retail to final client:
- 62%: 5 km, by passenger car (average)
- 5%: 5 km round trip, by van (lorry <7.5t, EURO 3 with utilisation ratio of 20%)
- 33%: no impact modelled

‘**X%**’ is mandatory primary data

Capital goods – infrastructure and equipment

- Capital goods (including infrastructures) and their end of life should be excluded, unless there is evidence from previous studies that they are relevant.
- If capital goods are included, the EF report shall include a clear and extensive explanation, reporting all assumptions made.

Storage at distribution centre or retail



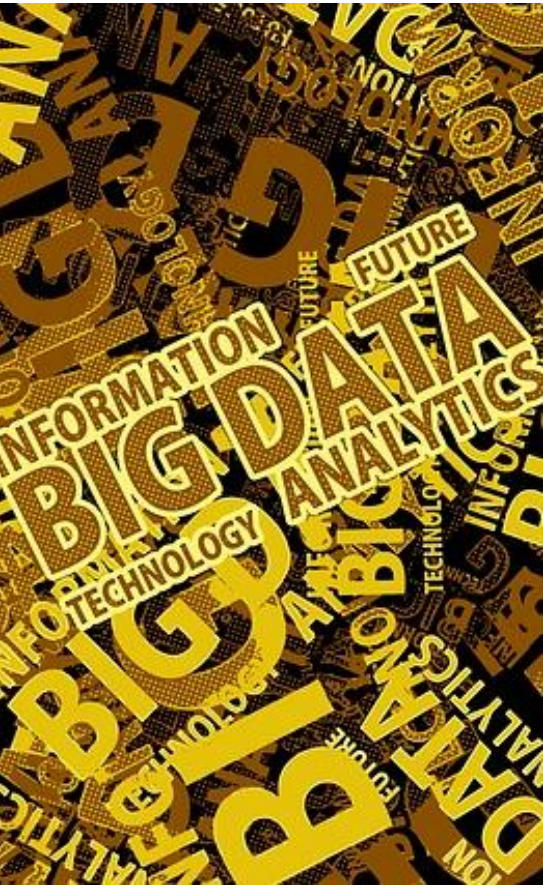
To consider energy consumption and refrigerant gases of storage activities, the EF Method provides default data that shall be used unless better data available for the following storage locations and activities

- Energy consumption at distribution centre
- Energy consumption at retail
- Refrigerant gases consumption and leakages at DCs with cooling systems

The minimum primary data the user shall have to use the above default data are

- Floor space (distribution centres)
- Building volume (for chilled or frozen storage)
- Building surface area (for retail)

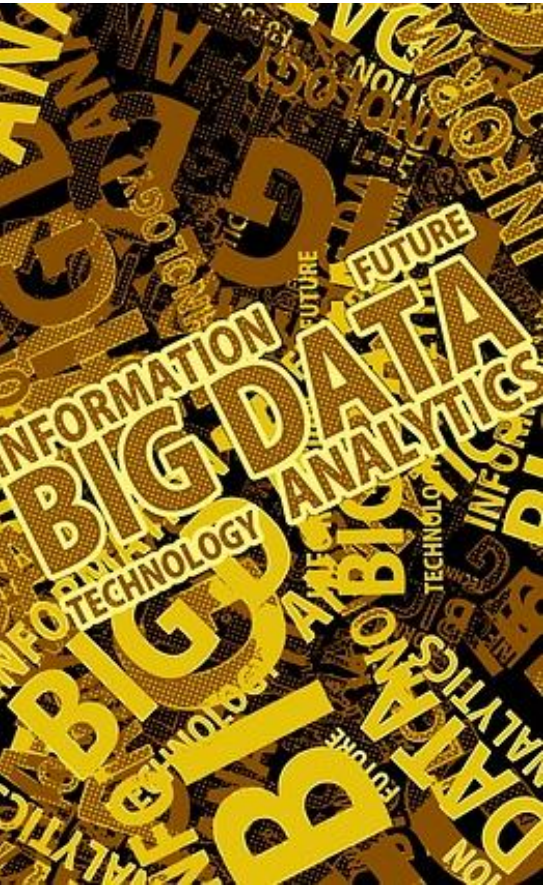
Sampling procedure



- Sampling might be necessary to limit data collection to a representative sample.
- If this is the case, the user of the EF method shall
  a. specify in the EF report if sampling was applied
  b. follow the requirements described in this section 4.4.6
  c. indicate which approach was chosen
- The representative sample shall be derived via a stratified sample (ensures that sub-populations (strata) are each adequately represented)

Sampling procedure (2)

Stratified sample



Stratification - the process of dividing members of the population into homogeneous sub-populations.

Sub-populations should be mutually exclusive: every element in the population shall be assigned to only one sub-population.

Aspects at least to be considered:

- Geographical distribution of sites;
- Technologies/ farming practices involved;
- Production capacity of companies/ sites

$$Nsp = g * t * c$$

Nsp: number of sub-populations

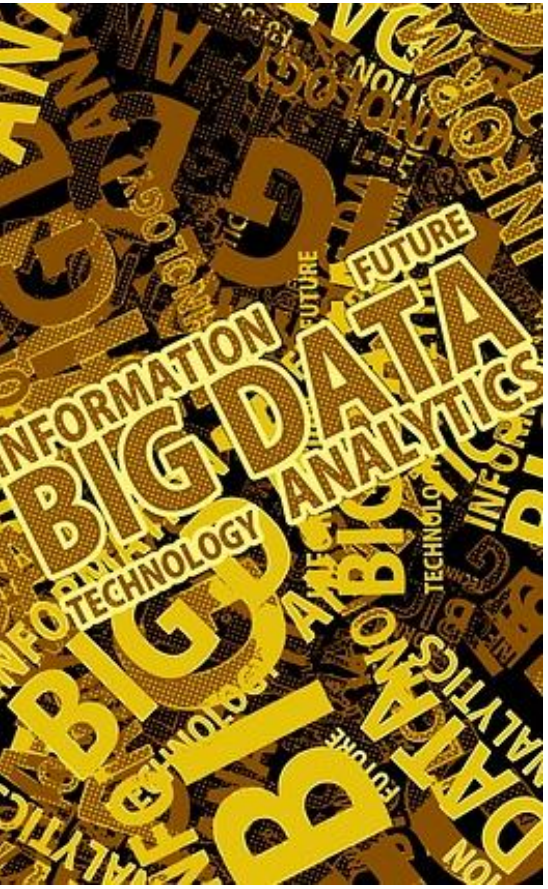
g: number of countries in which the sites/plants/farms are located

t: number of technologies/farming practices

c: number of classes of capacity of companies

Sampling procedure (3)

Sample size



1) Based on total production

Each sub-population ≥ 50% of their production

2) Based on the number of sites/farms/plants

$$n_{SS} = \sqrt{n_{SP}}$$

nSS: required sub-sample size

nSP: sub-population size

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

Use stage (1)

The use stage starts at the moment the end user uses the product till it leaves its place of use and enters the end of life (EoL) life cycle stage (e.g., recycling or final treatment).

- Often involves multiple processes
- Distinction to be made between (a) product independent and (b) product dependent processes
- **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.
  - Example: use of a glass for drinking wine
- **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 contribute to differentiation between two products.
  - Example: energy use of electric equipment when used in normal conditions

Use stage (2)

- **Product dependent processes** shall be included in the system boundary of the EF study
  - *Directly or indirectly determined or influenced by the product design or use instructions*
  - *Examples: Energy use of electric equipment; instructions on how long the food must be cooked; how much water must be used*
- **Product independent processes** shall be excluded from the system boundary and qualitative information may be provided
  - *No relationship with the way the product is designed or distributed*
  - *Examples: Use of a glass for drinking wine; frying time when using olive oil*
- For final products the LCIA results of the use stage shall be reported separately and as sum with all other life cycle stages (total life cycle).

Use stage (3)

Main function approach or delta approach

- Main function approach: the use stage processes are related to the main function of the product
  - e.g. the total cooking time and gas consumption when boiling pasta are directly related to eating pasta
- Delta approach: The use of one product may influence the env. impact of another product.
  - e.g. a third party toner cartridge may increase paper use due to inefficiency → in those cases the additional paper should be considered

End of life modelling – CFF formula

The Circular Footprint Formula (CFF)

LCI from virgin/primary material

LCI associated to recycled content input

LCI from the recycling (or reuse) process from which the credit from avoided virgin material are substracted

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

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

LCI from the disposal

LCI from the energy recovery process from which avoided emissions arising from the substituted energy source have been substracted

End of life modelling – A factor

The A factor

- The A factor allocates burdens and credits from recycling and virgin material production between two life cycles
- A=1 would reflect a 100:0 approach (i.e. credits are given to the recycled content)
- A=0 would reflect a 0:100 approach (i.e. credits are given to the recyclable materials at the end of life).
- PEF/OEF studies shall apply factor in the range **$0.2 \leq A \leq 0.8$**

End of life modelling – B factor

The B factor

- The B factor is used as an allocation factor of energy recovery processes
- Applies both to burdens and credits
- In EF studies the B value shall be **equal to 0 as default**.

End of life modelling – Point of substitution

The point of substitution

» Necessary to be determined for the material part of the formula

» Point of substitution = point in the value chain where secondary materials substitute primary materials.

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

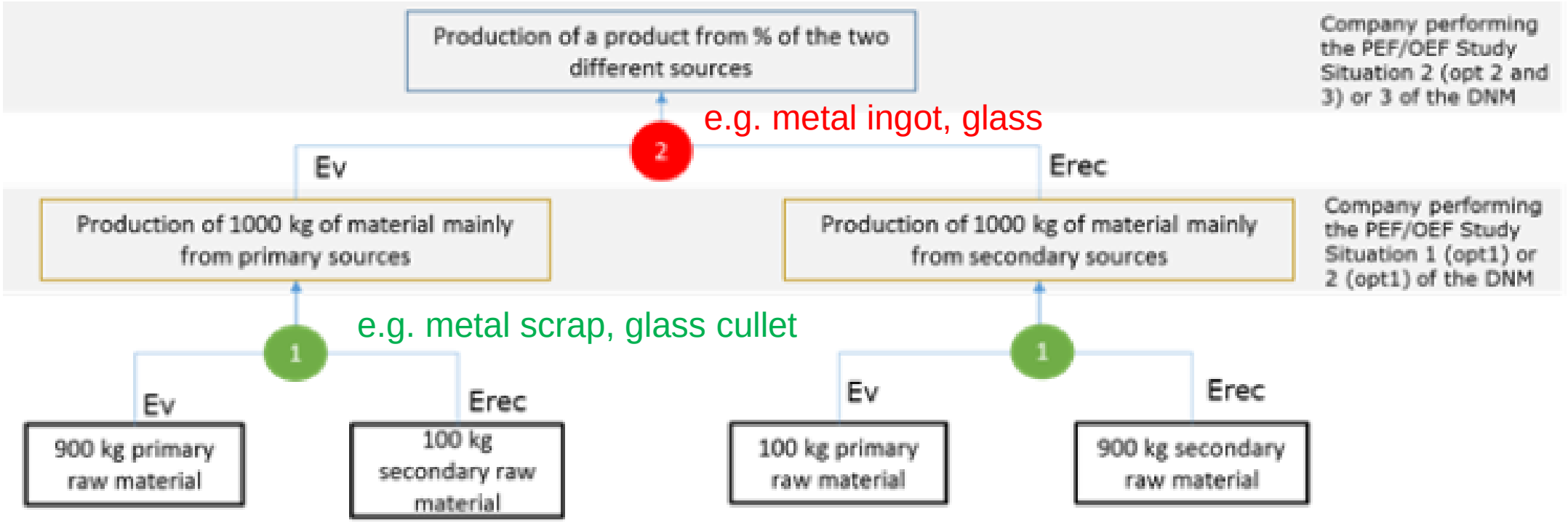
$$(1-B)R_3 \times (E_{ER} - LHV \times X_{ER,heat} \times E_{SE,heat} - LHV \times X_{ER,elec} \times E_{SE,elec})$$

Disposal

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

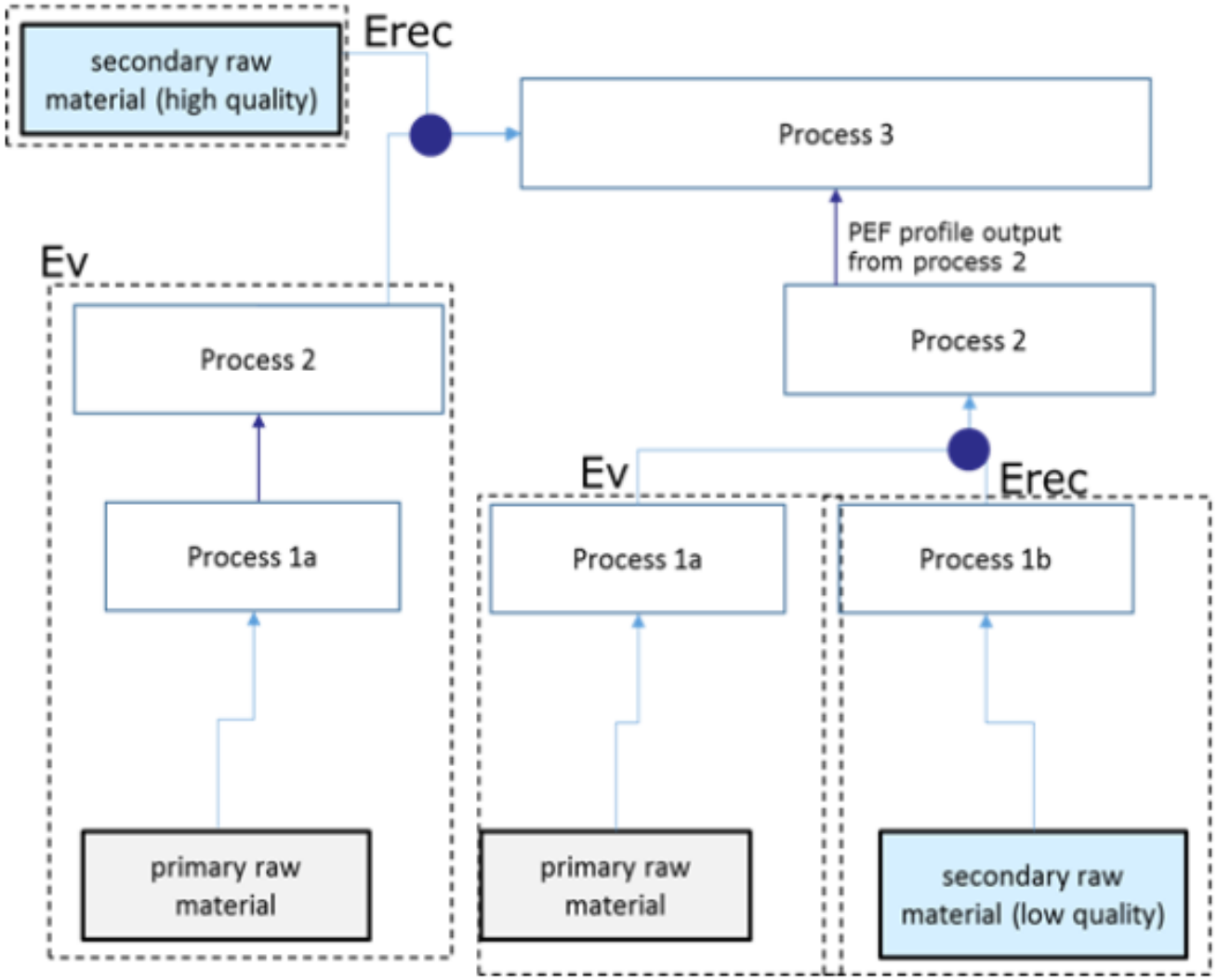
End of life modelling – Point of substitution

Point of substitution at level 1 and at level 2



End of life modelling – Point of substitution

Example of point of substitutions at different steps in the value chain, where e.g. scrap of two different qualities is processed at different steps



End of life modelling – Quality ratios

The quality ratios: Qsin/Qp and Qsout/Qp

- Accounts for quality of both ingoing and outgoing recycled materials
- If **Ev=E*v**, the two quality ratios are needed: Qsin/Qp associated to the recycled content, and Qsout/Qp associated to recyclability at EoL -> to capture downcycling
- If **Ev≠E*v**, one quality ratio is needed: Qsin/Qp associated to the recycled content.

End of life modelling – Recycled Content

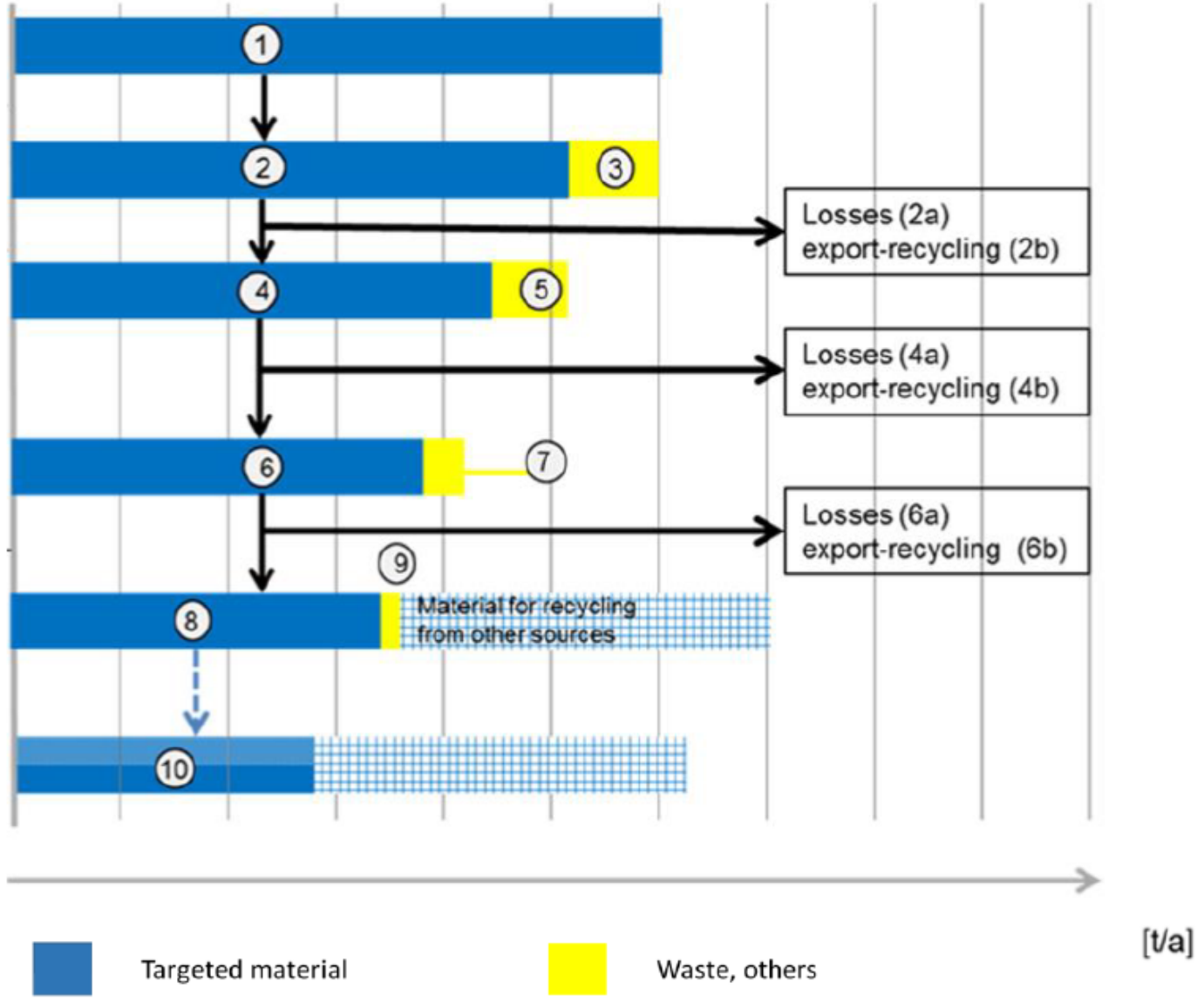
Recycled content (R1)

- R1 values shall be supply-chain or application-specific
- Default application specific R1 values are available in Annex C
- Hierarchical order to select R1 value:
  - Supply-chain specific values shall be used when the process is run by the company performing the EF study or when the process is not run by the company performing the EF study but the company has access to (company-)specific information.
  - In all other cases, the default secondary R1 values of Annex C (application-specific) shall be applied. R1=0% when no application-specific value available
  - Material-specific values based on supply market statistics are not accepted as a proxy and therefore shall not be used.

End of life modelling – Recycled output rate

Recycling output rate (R2)

- Company-specific values shall be used if available
- Default values are available in Annex C



Often, values available for point 8 and should be corrected to the actual output recycling rate (point 10)

End of life modelling – E_{rec} and E_{recEoL}

$E_{recycled}$ (E_{rec}) and $E_{recyclingEoL}$ (E_{recEoL})

- System boundary shall consider all the emissions and resources consumed starting from collection up to the defined point of substitution
- Close loop recycling: $E_{rec} = E_{recEoL}$

End of life modelling – E^*_v

- E*v = Ev: assume that recyclable material at EoL is replacing the same virgin material which was used at the input side to produce the recyclable material.
- If E*v ≠ Ev, E*v represents the actual amount of virgin material substituted by the recyclable material.
  - → E*v is not multiplied by Qsout/Qp
  - E*v shall be determined based on evidence of actual substitution of the selected virgin material.

Extended product lifetime

» Extending a product lifetime due to reuse or refurbishment of a product may result into two situations:

1) Resulting in a product with the original product specifications (providing same function)
   - Shall be included in the FU (“how long”) and reference flow:
     Basis = reuse rate e.g., if 10 reuses then reuse rate = 90%
     Calculate raw material acquisition, transport and EoL accordingly (10% of reuse rate is 90%)

2) Resulting in a product with different product specifications (providing another function)
   - Shall be considered as part of the CFF, as a form of recycling:
     Reuse/ refurbishment activities are part of the ErecEoL parameter
     *Alternative function provided (or the avoided production of parts or components) falls under the E*v parameter.*

Greenhouse gas emissions and removals

- Three categories of greenhouse (GHG) emissions and removals shall be distinguished:
  - Fossil GHG emissions and removals (contributing to the sub-category '**Climate change – fossil**');
  - Biogenic carbon emissions and removals (contributing to the sub-category '**Climate change – biogenic**');
  - Carbon emissions from land use and land use change (contributing to the sub-category '**Climate change – land use and land use change**').

Greenhouse gas emissions and removals

The sub-categories shall be reported separately if they show a contribution of more than 5% each to the total score of climate change.

- No credits associated with temporary and permanent carbon storage and/or delayed emissions
- All emissions and removals shall be accounted for as emitted “now”
- No discounting of emissions over time (in line with ISO 14067:2018).

- For intermediate products (cradle-to-gate), the biogenic carbon content at factory gate (physical content) shall always be reported as ‘additional technical information’.

Greenhouse gas emissions and removals

Climate change – fossil

» Covers carbon 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.).

» Modelling requirements: The flows shall be modelled with the elementary flows in the most updated EF reference package and using the names ending with ‘(fossil)’, if available (e.g., ‘carbon dioxide (fossil)’ and ‘methane (fossil)’).

Greenhouse gas emissions and removals

Climate change – biogenic

- Covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of aboveground biomass
- The flows shall be modelled with the elementary flows in the most updated EF reference package and using the names ending with '(biogenic)'

Greenhouse gas emissions and removals

Climate change – land use and land use change (LULUC)

- 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;
- Direct land use change occurs as the result of a transformation from one land use type into another;
- Indirect land use change occurs when a certain change in land use, induces changes in land use outside the system boundary.
  - Not considered within the EF method
- Modelling requirements: The flows shall be modelled with the elementary flows in the most updated EF reference package and using the names ending with '(land use change)'

Greenhouse gas emissions and removals

Climate change – land use change (LUC)

- Carbon emissions and removals shall be modelled following PAS 2050:2011 (BSI 2011) and supplementary PAS2050-1:2012 (BSI 2012) for horticultural products
- Use default land use change values in Annex C of PAS 2050 unless better data is available
- LUC not considered if >20 years or a single harvest period (whichever is longer) prior to assessment
- Soil carbon
  - Emissions shall be included
  - Carbon uptake (accumulation) shall be excluded
  - Soil carbon storage may only be included in the EF study as additional environmental information and if proof is provided.

Offsets

- GHG mitigation activities and discrete greenhouse gas (GHG) reductions used to compensate for (i.e., offset) GHG emissions elsewhere
- Offsets shall not be included in the impact assessment of a EF study, but may be reported separately as additional environmental information

Agricultural production

Handling multi-functional processes

» Rules from LEAP Guideline shall be followed: Environmental performance of animal feeds supply chains (pages 36-43), FAO 2016, available at http://www.fao.org/partnerships/leap/publications/en/

Crop type specific and country, region or climate specific data

» For yield, water and land use, land use change, fertilizer (artificial and organic) amount (N, P amount) and pesticide amount, per hectare per year: **crop type specific and country-region-or-climate specific data should be used**

Agricultural production

Averaging data

» Data shall be collected over a period of time sufficient to provide an average assessment that offsets seasonal differences, following LEAP guidelines:

- Annual crops: assessment period of at least three years; exceptions may apply, but period shall not be less than 1 year.
- Perennial plants: steady state situation shall be assumed and a three-year period shall be used for inputs and outputs
- Correction if different stages in cycle are disproportional by adjusting crop area allocated to different development stages in proportion to the crop areas expected in a theoretical steady state
- Crops grown in <1 year (e.g. lettuce): data shall be collected in relation to the specific time period for production of a single crop, from at least three recent consecutive cycles.

Agricultural production

Pesticides

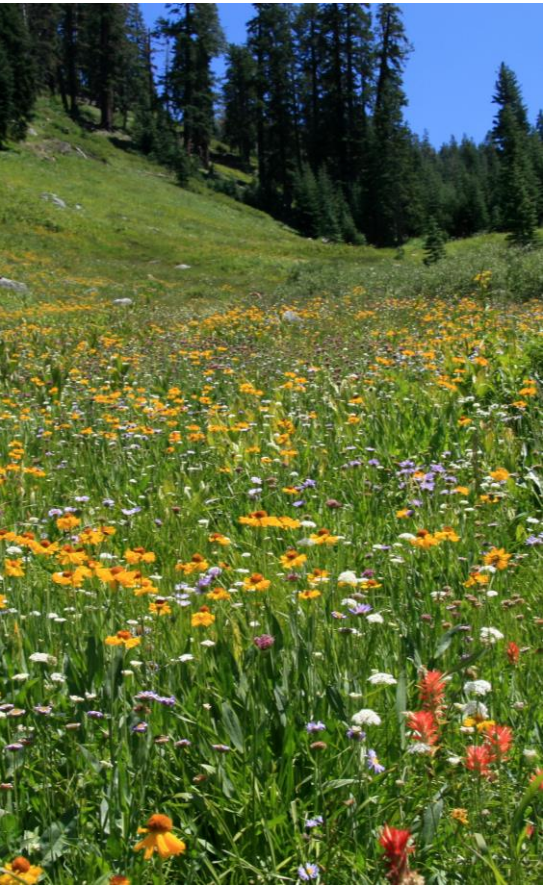
- Pesticide emissions shall be modelled as specific active ingredients
- Pesticides applied on the field shall be modelled as:
  - 90% emitted to the agricultural soil compartment
  - 9% emitted to air
  - 1% emitted to water
- Use more specific data of available

Agricultural production

Fertilisers

- Shall be differentiated per fertiliser and cover as a minimum:
  - NH3, to air (from N-fertiliser application);
  - N2O, to air (direct and indirect) (from N-fertiliser application);
  - CO2, to air (from lime, urea and urea-compounds application);
  - NO3, to water unspecified (leaching from N-fertiliser application);
  - PO4, 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)
- Tier 1 emission factors of IPCC 2006 (modified) are given in *Method* document, Table 3
- Nitrogen modelling using alternative approach may be applied and reported in an Annex of the PEF report

Agricultural production



Heavy metal emissions

- Heavy metal emissions from field inputs shall be modelled as emission to soil and/or leaching or erosion to water
- Inventory to water shall specify the oxidation state of the metal (e.g., Cr+3, Cr+6)
- How to model crops that act as a sink, i.e. that assimilate part of the heavy metal emissions
  a. 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
  b. 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.

Agricultural production

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)

Peat soils

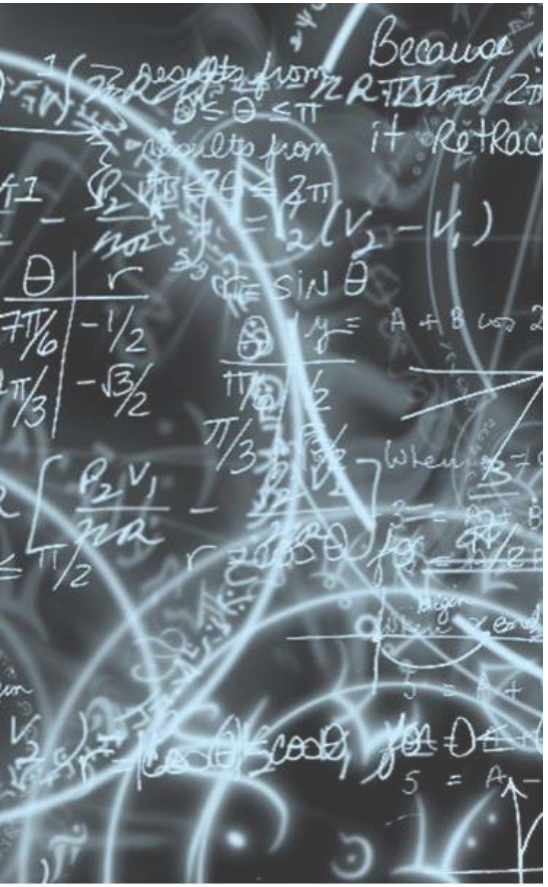
» Drained peat soils shall include carbon dioxide emissions on the basis of a model that relates the drainage levels to annual carbon oxidation.

Other activities, if applicable

- Input of seed material (kg/ha),
- Input of peat to soil (kg/ha + C/N ratio),
- Input of lime (kg CaCO3/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.

Data requirements

Two types of datasets



Company-specific datasets

- Directly measured or collected at a specific facility or set of facilities
- Data shall include all known inputs and outputs for the processes.
- The data may be collected, measured or calculated using company-specific activity data and related emission factors.
- All inputs and outputs need to be scaled to the reference flow of the process and shall be specific to the product in scope of the study.
- All new datasets created when conducting a EF study shall be EF-compliant.

» Secondary datasets

- Generic data from literature or scientific papers
- Average data from LCA databases, industry association reports, government statistics, etc.
- All secondary datasets shall fulfil the data quality requirements (DQR). Data sources shall be clearly documented and reported in the EF report.

Note: For PEFCRs/OEFSRS in the transition phase and PEF/OEF studies that implement these, up to 10% "ILCD entry-level" datasets are allowed,

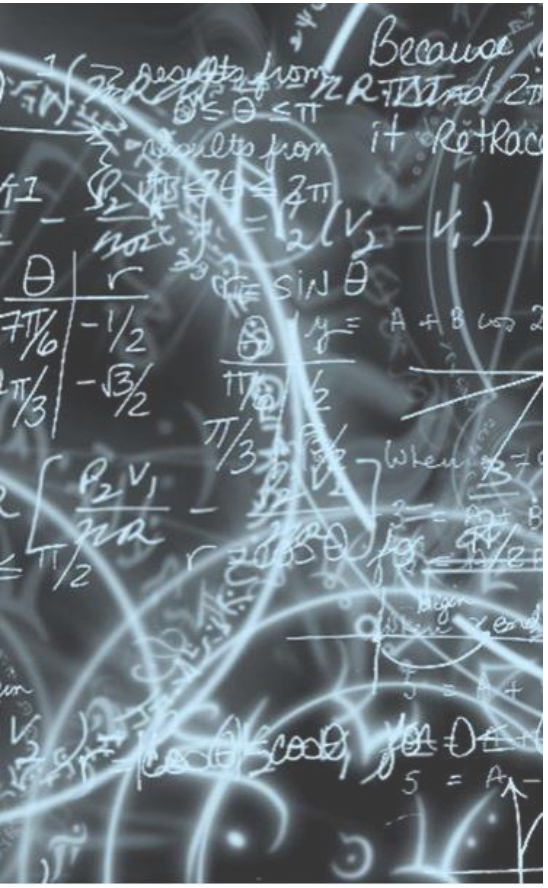
Data needs matrix (DNM)

- Data needs matrix (DNM) indicates for which processes in scope company-specific or secondary data shall or may be used – depending on the level of influence the company has on the process
- Three cases are distinguished:
  1) **Situation 1**: the process is run by the company performing the EF study
  2) **Situation 2**: the process is not run by the company performing the EF study, but the company has access to (company-)specific information
  3) **Situation 3**: the process is not run by the company performing the EF study, and the company does not have access to (company-)specific information

Note that level-1 partially disaggregated datasets are used exclusively for Situation 2, Option 2.

		Data requirements
Situation 1: process run by the company	**Option 1**	Provide company-specific data (both activity data and direct emissions) and create a company-specific dataset (DQR≤1.5). Calculate DQR of the dataset following the rules at section 4.6.5.2.
Situation 2: process not run by the company but with access to company-specific information	**Option 1**	Provide company-specific data and create a company-specific dataset (DQR≤1.5). Calculate DQR of the dataset following the rules at section 4.6.5.2.
	Option 2	Use an EF-compliant secondary dataset and apply 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). Recalculate DQR of the dataset used (see section 4.6.5.6).
Situation 3: process not run by the company and without access to company-specific information	**Option 1**	Use an EF-compliant secondary data set in aggregated form (DQR≤3.0). Recalculate DQR of the dataset if the process is most relevant (see section 4.6.5.7)

Which secondary datasets to use?



1) PEF studies shall use secondary datasets that are EF compliant. If not available, use (in order of preference):

2) EF-compliant proxy
   - the use of proxy datasets shall be reported in the limitations section of the PEF report.

3) ILCD entry level (EL) compliant proxy
   - A maximum of 10% of the total environmental impact may be derived from ILCD-EL compliant datasets (calculated cumulatively from lowest to largest contribution to the total EF profile).

4) If none of the above available, process shall be excluded
   - This shall be clearly stated in the in the “limitations” section of the PEF report as a data gap and validated by the verifier.

Data quality

- Data quality is an important aspect to evaluate the validity of EF studies
- To assess data quality of processes, different data quality criteria are defined:

Minimum requirements	• Completeness • Methodological appropriateness and consistency[69]
Data quality criteria (scored)	• Technological representativeness[70] (TeR) • Geographical representativeness[71] (GeR) • Time-related representativeness[72] (TiR) • Precision[73] (P)
Documentation	• Compliant with the ILCD format
Nomenclature	• Compliant with the ILCD nomenclature structure (use of EF reference elementary flows for IT compatible inventories; see detailed requirements at section 4.3)
Review	• Review by "Qualified reviewer" • Separate review report

⇒ Used to calculate the data quality rating (DQR)

Data quality rating (DQR) (I)

- Each data quality criterion to be scored (i.e. TeR, GeR, TiR and P) is rated using a scale from 1 to 5:

Data Quality Rating of Data Quality Criteria (TeR, GeR, TiR, P)	Data Quality Level
1	Excellent
2	Very Good
3	Good
4	Fair
5	Poor

- Example:

Rating	P_{EF} and P_{AD}	$Ti_{R\text{-}EF}$ and $Ti_{R\text{-}AD}$	$Te_{R\text{-}EF}$ and $Te_{R\text{-}AD}$	$G_{R\text{-}EF}$ and $G_{R\text{-}AD}$
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 elementary flows and the activity data exactly the technology of the newly developed dataset	The activity data and elementary flows reflects the exact geography where the process modelled in the newly created

Data quality rating (DQR) (II)

- Based on the rating, the DQR for each new EF dataset shall be calculated and reported with this formula:

$$DQR = \frac{TeR+GeR+TiR+P}{4}$$

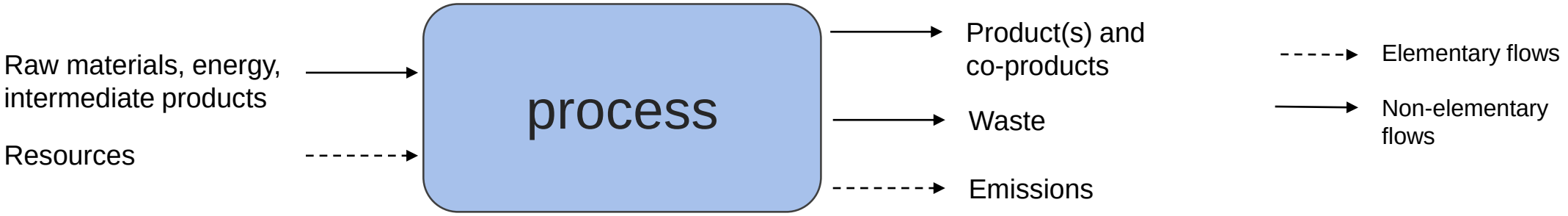
- The formula is applicable to company-specific datasets, secondary datasets and EF studies
- Overall data quality rating – correspondence with numeric DQR value:

Overall data quality rating (DQR)	**Overall data quality level**
DQR ≤ 1.5	"Excellent quality"
1.5 < DQR ≤ 2.0	"Very good quality"
2.0 < DQR ≤ 3.0	"Good quality"
3 < DQR ≤ 4.0	"Fair quality"
DQR >4	"Poor quality"

EF compliant datasets

Processes and flows

- Processes are core elements to model product life cycles in LCA.
- Processes have different inputs and outputs, which are called flows.
- There are different flow types:
  - » **Elementary flows: "***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*" (ISO 14040)
  - » **Non-elementary (or complex) flows** include all the inputs (e.g. electricity, materials, transport processes) and outputs (e.g. waste, by-products) in a system that need further modelling efforts to be transformed into elementary flows.
  - » Each process needs a **reference flow**; it reflects the main product of the process



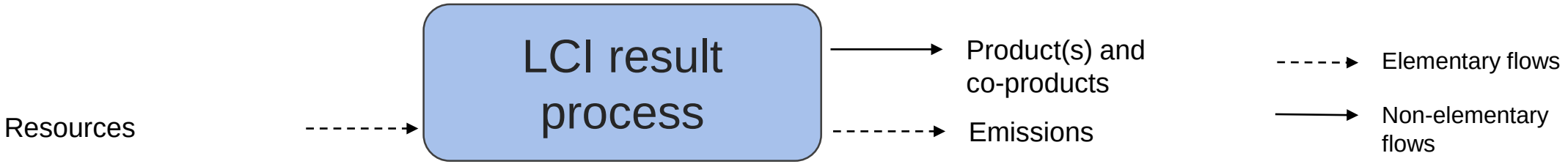
Flow properties and units

- Each flow has a reference flow property.
- Each flow property has a reference unit group.
- Each unit group has a reference unit and other units that are scaled based on the reference unit.
- Examples:

Flow property	Reference unit group	Reference unit	Other units
Mass	Units of mass	kg	t, mg, g, etc.
Net calorific value	Units of energy	MJ	kWh, MWh, kcal, etc.
Radioactivity	Units of radioactivity	kBq	Bq, Ci, Rutherford

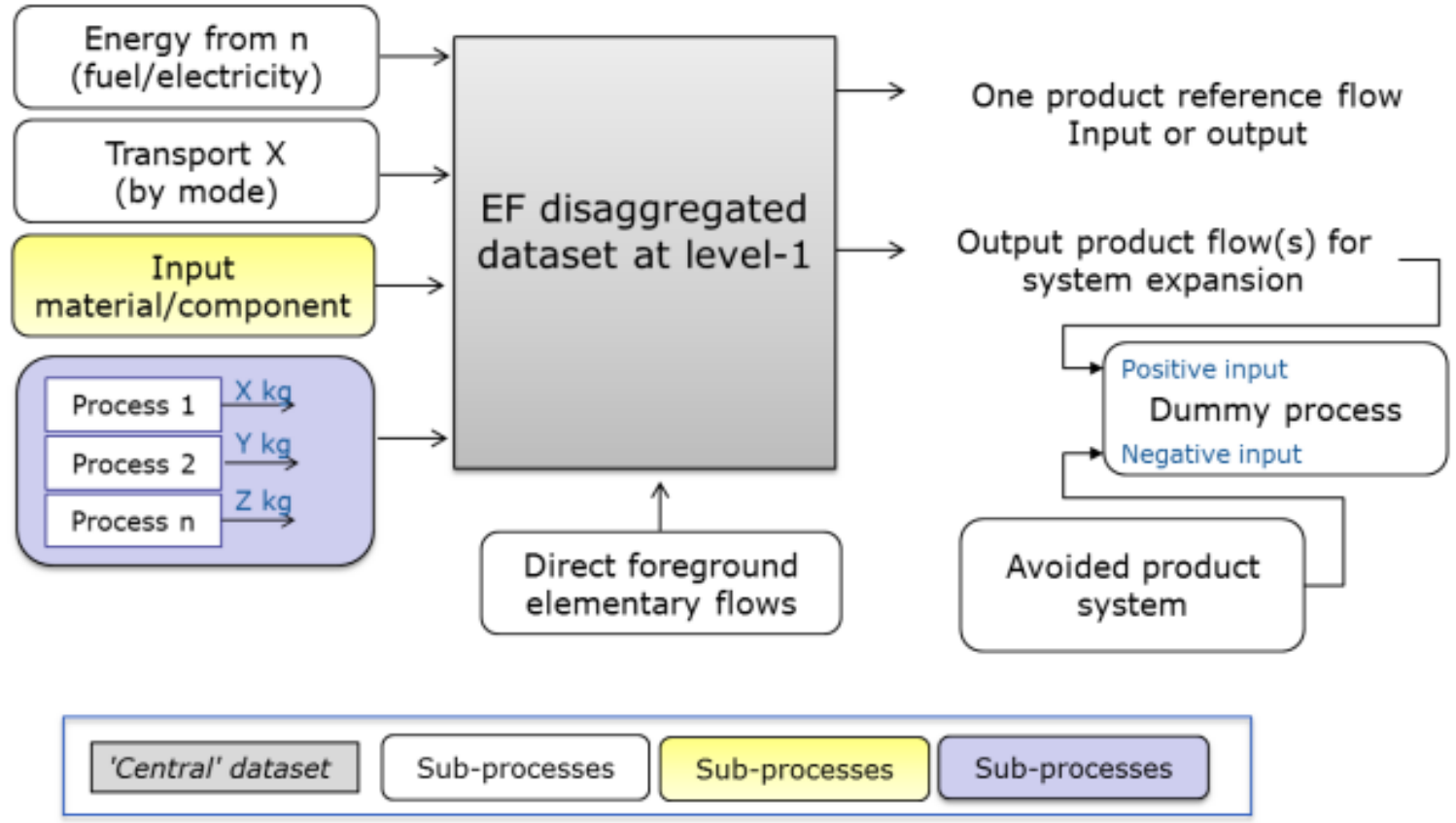
Aggregated & disaggregated

- An EF compliant dataset can be available in aggregated format and partially disaggregated format at level-1:
  - **Aggregated dataset** (LCI result): Complete or partial life cycle of a product system that next to the elementary flows lists in the input/output list exclusively the product(s) of the process as reference flow(s), but no other goods or services.



  - **Partially disaggregated dataset**: A dataset with a LCI that contains elementary flows and activity data, and that only in combination with its complementing supporting datasets yield a complete aggregated LCI data set.
  - **Partially disaggregated dataset at level-1**: A partially disaggregated dataset at level-1 contains elementary flows and activity data of one level down in the supply chain, while all complementing supporting datasets are in their aggregated form (*see next slide*).

Partially disaggregated dataset at level-1



For more details check the latest version of the PEF/OEF method available at http://eplca.jrc.ec.europa.eu/EnviromentalFootprint.html

EF compliance

1) Modelling compliance (capital goods, CFF, etc.)

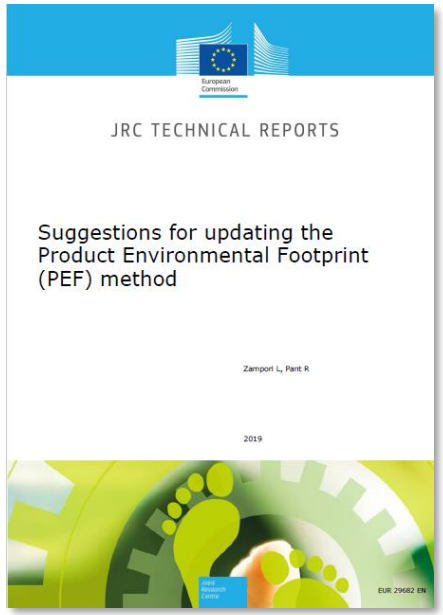
EF Methods
https://eplca.jrc.ec.europa.eu/permalink/PEF_method.pdf

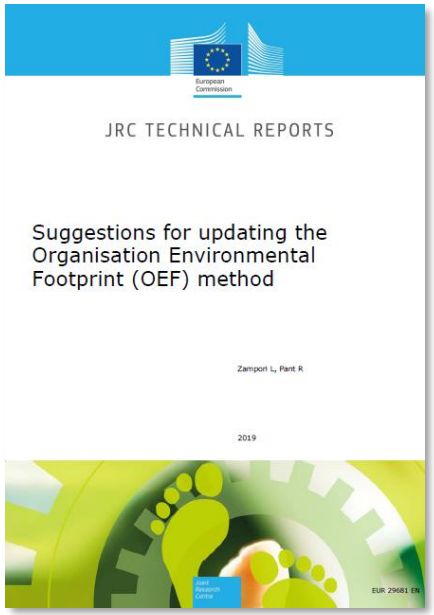
2) Meta data compliance (e.g. DQR, extent of documentation, etc.)

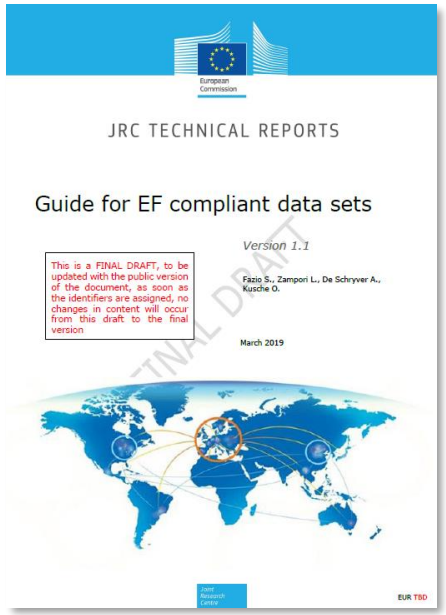
Guide on EF data:
https://eplca.jrc.ec.europa.eu/permalink/Guide_EF_DATA.pdf

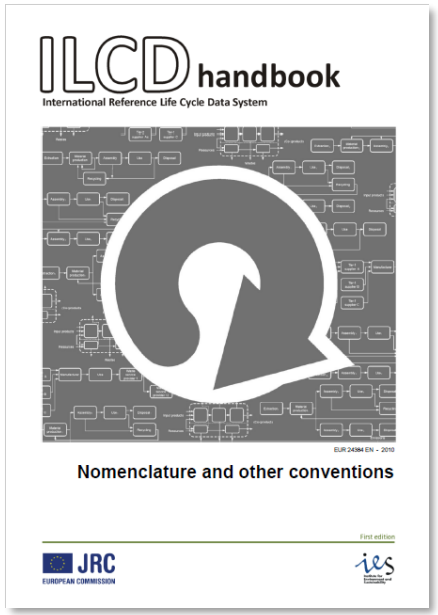
3) Nomenclature and CF
Dictionary to develop EF compliant dataset (=flow list, properties, impact factors, …)

EF reference package (EF 2.0 or 3.0)
http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml



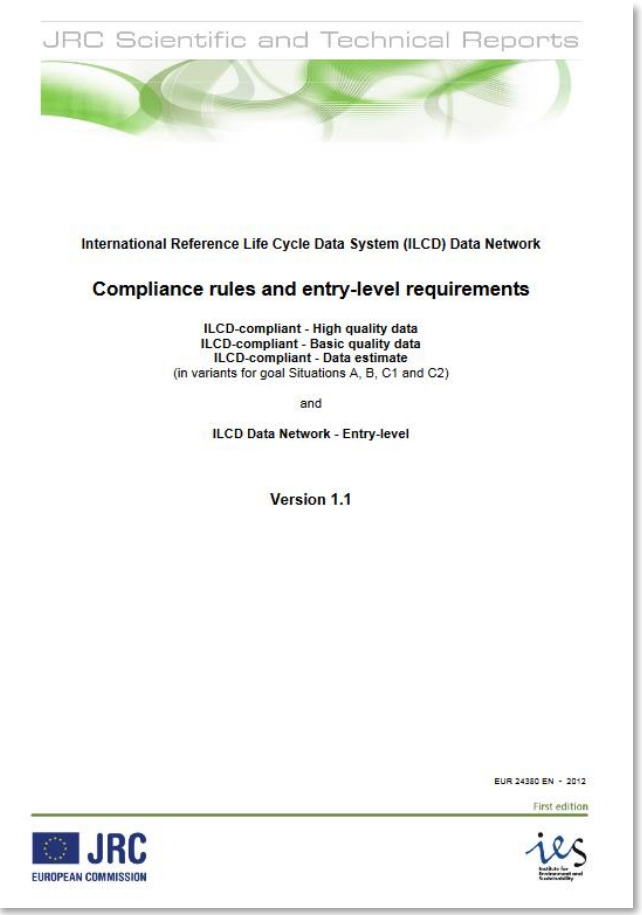






EF compliance – meta data (1)

ILCD Entry Level requirements


JRC Scientific and Technical Reports

International Reference Life Cycle Data System (ILCD) Data Network

Compliance rules and entry-level requirements

ILCD-compliant - High quality data
ILCD-compliant - Basic quality data
ILCD-compliant - Data estimate
(in variants for goal Situations A, B, C1 and C2)

and

ILCD Data Network - Entry-level

Version 1.1

EUR 24380 EN - 2012

First edition

JRC EUROPEAN COMMISSION

https://eplca.jrc.ec.europa.eu/uploads/ILCD-Data-Network-Compliance-Entry-level-Version1.1-Jan2012.pdf

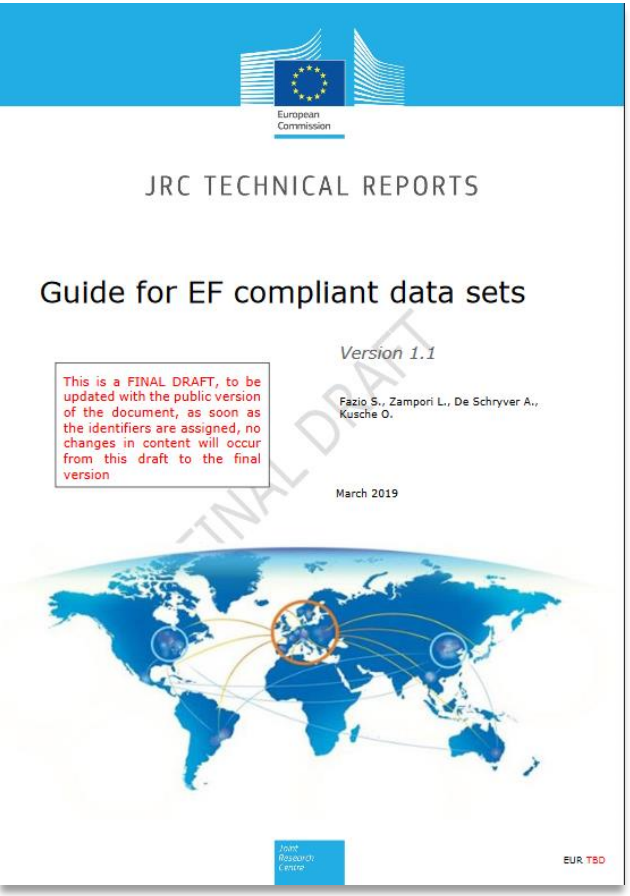
Compliance area	ILCD Data Network - Entry-level
Documentation	• Minimum documentation extent specified • ILCD format to be used
Nomenclature	• Compliance with ILCD nomenclature document (e.g. use of ILCD reference elementary flows), • *Certain aggregated elementary flows (e.g. VOC) are permitted* • *Terminology use not enforced.*
Data quality	• *"Not defined", i.e. no data quality levels (Note: this requirement is covered as part of "Documentation")* • *Data quality needs to be stated using ISO quality criteria* • Technological, geographical and time-related representativeness to be documented
Method	• ISO 14040 and 14044 compliant process-based LCA • *Methodological ILCD-compliance not enforced; applied modelling framework(s) and allocation/substitution approaches to be documented*

Review	▪ *Use of reviewers from registry not required*
	▪ *"Qualified reviewer" required (based on ISO 14025):*
	  • *knowledge of relevant sector*
	  • *knowledge of represented process or product*
	  • *LCA method expertise and experience*
	• *Qualified independent external reviewer in line with ISO 14044 (chapter 6.1) requirements BUT separate review report is not required (review documented in data set) OR*
	• *Qualified independent internal reviewer in line with ISO 14044 (chapter 6.1) requirements, BUT* separate review report is required (with the ILCD template / minimum review documentation scope), in addition to review documentation provided within data set
	• *Review on unit process level may not be required, depending on data quality claims*

Remark: italics identifies less strict requirement than full ILCD-compliance

EF compliance – meta data (2)

Guide for EF compliant data sets



- Guide for EF compliant datasets
  - Data set types
  - Procedures for updates
  - Requirements on meta data information
  - More details on some modelling requirements
  - Reviewer requirements
  - IP rights

- The documentation requirements of EF dataset meta-data information are additions to the ILCD DN entry-level requirements:

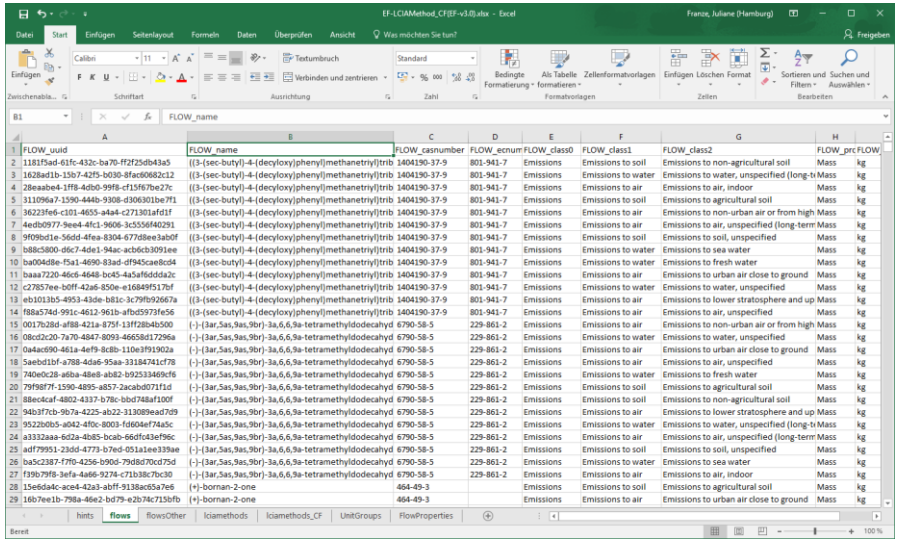
- Depending on the type of dataset, additional information needs to be provided:
  - » Information relevant for all datasets (e.g. numeric DQRs)
  - » Additional information relevant for partially disaggregated datasets (e.g. complementing processes)
  - » Information relevant to provided sub-processes

EF reference packages (nomenclature and CF's)

EF reference packages contain a set of files and folders in accordance with the ILCD format specification, including:
Nomenclature, flows (elementary, product, waste and other), flow properties linked to flows, external documents, characterization factors, process data sheets, conversion factors etc.)

Two EF reference packages available:

- » EF Reference Package 2.0: to be used for all EF studies using PEFCRs/OEFSRs developed in the **pilot** phase
- » EF Reference Package 3.0: to be used for all EF studies using PEFCRs/OEFSRs developed in the **transition** phase



Tendered background datasets in EF 3.0:

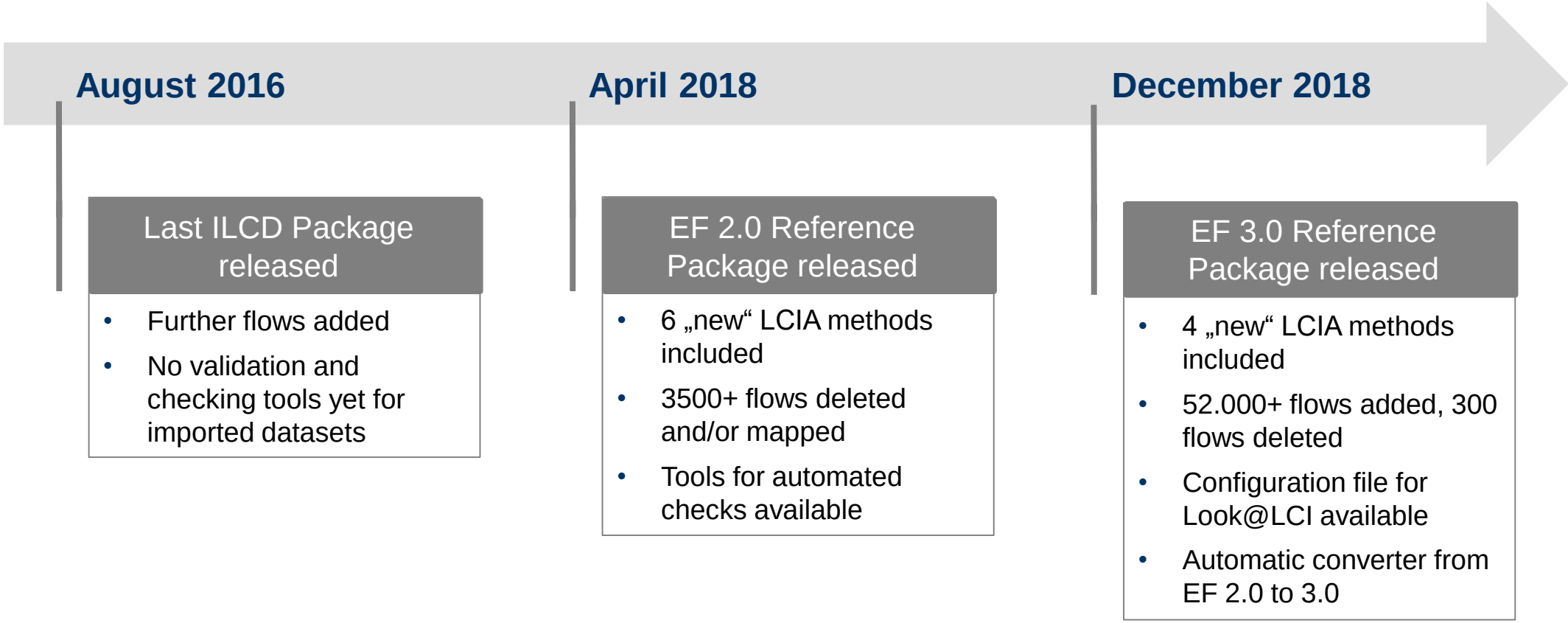
First datasets available in **October 2019**

(packaging, energy, end of life, transport)

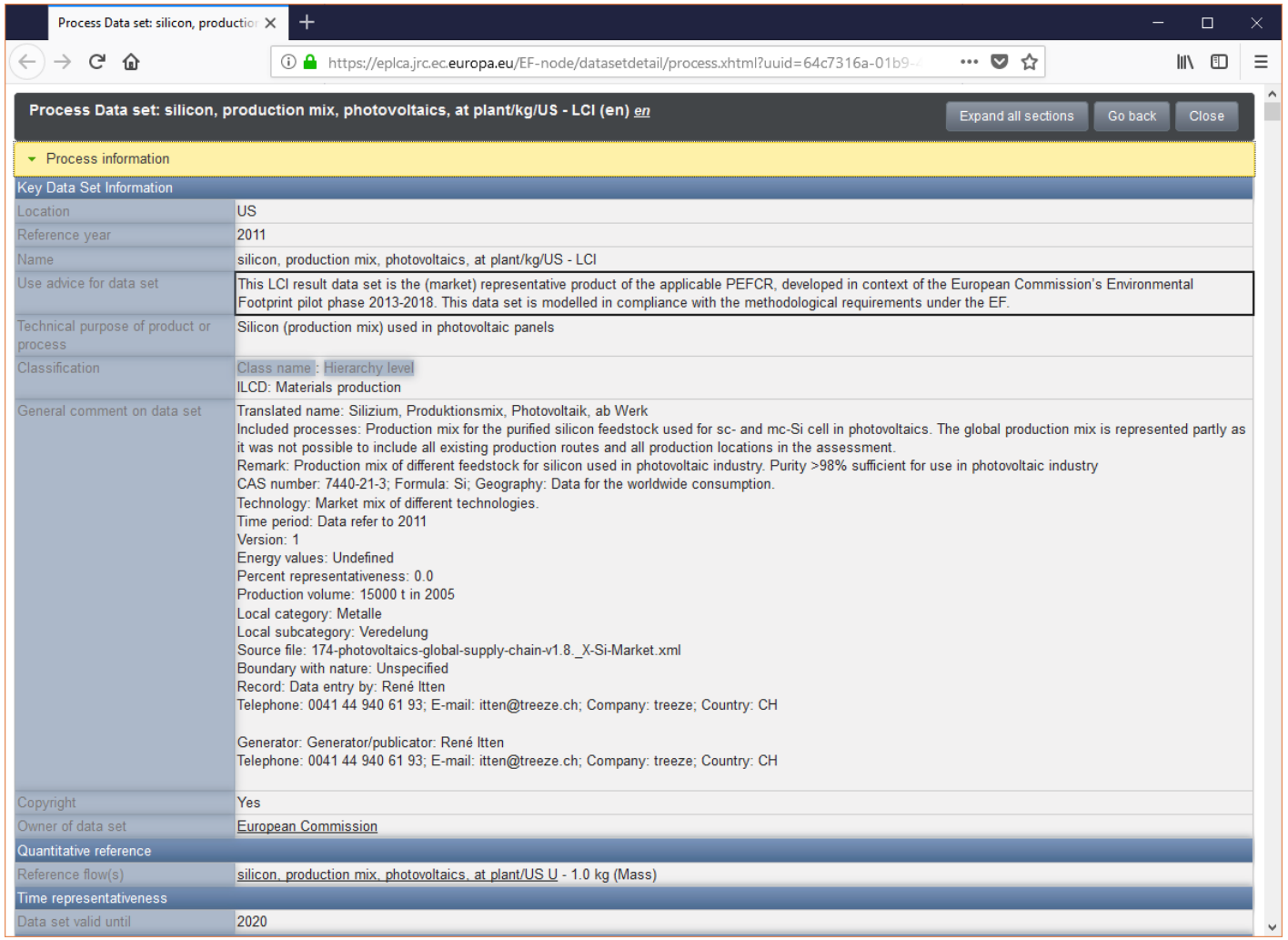
All other EF data: Earliest 1st of **March 2020**

From ILCD to EF reference package 3.0

- A Reference Package includes all reference files (flows, LCIA methods, flow properties, unit groups, contacts, sources) in ILCD archive structure (zip) and additional documentation (change logs, XLS package, etc.)



Example: process dataset



Link to dataset example

Impact assessment and interpretation

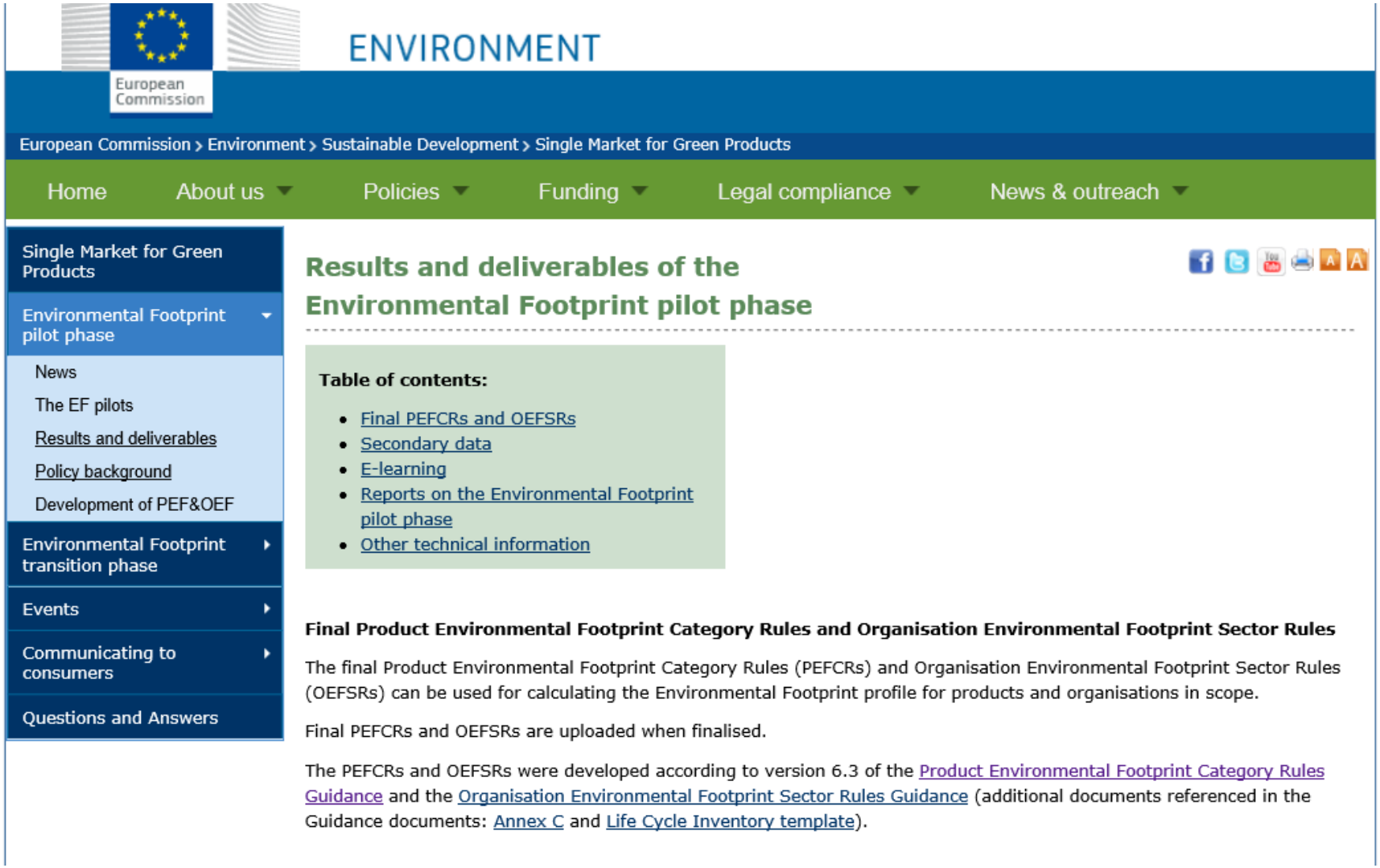
EF impact assessment

- Results shall be calculated and reported in the EF report as **characterised**, **normalised** and **weighted** results for each EF impact category **and as a single overall score** based on the weighting factors given
- Results shall be reported for (i) the total life cycle, and (ii) the total life cycle excluding the use stage.
- Substantial amount of information and documentation available in the EF Reference Package. Most relevant for the Impact Assessment:
  - Characterization factors
  - Normalisation factors
  - Weighting factors

Exercise 1 – Normalisation and Weighting

- Find PEFCR Rechargeable Batteries and life cycle inventory
- Find and apply normalization factors
- Develop and apply your own weighting factors, rank
- Calculate single overall score
- Find and apply default weighting factors, rank
- Compare
- Do a sensitivity check
- Discuss

Exercise 1 – Finding



Exercise 1 – Get information (example)

Characterised benchmark values for 4 representative products

Impact category (1.8.9.oct)	CPT - Li-ion	ICT - Li-ion	ICT - NiMH	e-mobility Li-ion	Normalization factors
Acidification terrestrial and freshwater [Mo	4,5E-03	3,2E-03	1,8E-02	9,3E-04	5,55E+01
Cancer human health effects [CTUh]	7,2E-09	6,7E-09	9,3E-09	2,4E-09	3,85E-05
Climate Change [kg CO2 eq.]	**1,0E+00**	**6,5E-01**	**1,0E+00**	**5,4E-01**	7,76E+03
Ecotoxicity freshwater [CTUe]	3,0E-01	2,4E-01	5,3E-01	8,8E-02	1,18E+04
Eutrophication freshwater [kg P eq.]	3,1E-05	2,8E-05	2,2E-05	1,7E-05	2,55E+00
Eutrophication marine [kg N eq.]	8,7E-04	5,6E-04	7,4E-04	4,1E-04	2,83E+01
Eutrophication terrestrial [Mole of N eq.]	8,7E-03	5,5E-03	7,3E-03	4,1E-03	1,77E+02
Ionising radiation - human health [kBq U23	1,4E-01	9,3E-02	1,6E-01	1,3E-01	4,22E+03
Land Use [Pt]	3,4E+00	2,3E+00	3,9E+00	2,6E+00	1,33E+06
Non-cancer human health effects [CTUh]	1,6E-07	9,5E-08	2,1E-07	3,5E-08	4,75E-04
Ozone depletion [kg CFC-11 eq.]	3,5E-09	8,3E-09	9,1E-09	2,4E-09	2,34E-02
Photochemical ozone formation - human health [kg NMVOC eq.]	2,4E-03	1,6E-03	3,0E-03	1,1E-03	4,06E+01
Resource use, energy carriers [MJ]	1,5E+01	9,8E+00	1,4E+01	9,1E+00	6,53E+04
Resource use, mineral and metals [kg Sb	3,2E-05	1,8E-05	3,0E-05	6,9E-06	5,79E-02
Respiratory inorganics [kg PM2.5 eq.]	5,8E-08	4,5E-08	1,7E-07	2,5E-08	6,37E-04
Water scarcity [m³ world equiv.]	2,3E-01	1,7E-01	2,6E-01	1,0E-01	1,15E+04

Source: PEFCR for High Specific Energy Rechargeable Batteries for Mobile Applications, Table 28; Normalization factors from EF2.0 package.

Note: Global normalisation factors, per capita, shall be used for EF studies.

Exercise 1 – Apply normalization

Characterised benchmark values from previous slide divided by normalization factors (NFs) from previous slide. Weighting factors (EF2.0) in the rightmost column are in %.

Impact category (1.8.9.oct)	CPT - Li-ion	ICT - Li-ion	ICT - NiMH	e-mobility Li-ion	Weighting factors (%)
Acidification terrestrial and freshwater [Mo	8,0E-05	5,8E-05	3,3E-04	1,7E-05	6,2
Cancer human health effects [CTUh]	1,9E-04	1,7E-04	2,4E-04	6,2E-05	2,13
Climate Change [kg CO2 eq.]	1,3E-04	8,4E-05	1,3E-04	7,0E-05	21,06
Ecotoxicity freshwater [CTUe]	2,5E-05	2,0E-05	4,5E-05	7,4E-06	1,92
Eutrophication freshwater [kg P eq.]	1,2E-05	1,1E-05	8,7E-06	6,7E-06	2,8
Eutrophication marine [kg N eq.]	3,1E-05	2,0E-05	2,6E-05	1,5E-05	2,96
Eutrophication terrestrial [Mole of N eq.]	4,9E-05	3,1E-05	4,1E-05	2,3E-05	3,71
Ionising radiation - human health [kBq U23	3,3E-05	2,2E-05	3,7E-05	3,1E-05	5,01
Land Use [Pt]	2,5E-06	1,8E-06	3,0E-06	1,9E-06	7,94
Non-cancer human health effects [CTUh]	3,4E-04	2,0E-04	4,5E-04	7,4E-05	1,84
Ozone depletion [kg CFC-11 eq.]	1,5E-07	3,6E-07	3,9E-07	1,0E-07	6,31
Photochemical ozone formation - human health [kg NMVOC eq.]	5,9E-05	3,8E-05	7,3E-05	2,6E-05	4,78
Resource use, energy carriers [MJ]	2,3E-04	1,5E-04	2,2E-04	1,4E-04	8,32
Resource use, mineral and metals [kg Sb	5,5E-04	3,0E-04	5,1E-04	1,2E-04	7,55
Respiratory inorganics [kg PM2.5 eq.]	9,0E-05	7,0E-05	2,7E-04	4,0E-05	8,96
Water scarcity [m³ world equiv.]	2,0E-05	1,5E-05	2,3E-05	8,8E-06	8,51

Note: Weighting factors are in %. The above default weighting factors were developed by JRC as a hybrid evidence- and judgement-based weighting set.

Exercise 1 – Apply weighting

EF weighted results

Impact category (1.8.9.oct)	CPT - Li-ion	ICT - Li-ion	ICT - NiMH	e-mobility Li-ion
Acidification terrestrial and freshwater [Mo	5,0E-04	3,6E-04	2,1E-03	1,0E-04
Cancer human health effects [CTUh]	4,0E-04	3,7E-04	5,1E-04	1,3E-04
Climate Change [kg CO2 eq.]	2,8E-03	1,8E-03	2,8E-03	1,5E-03
Ecotoxicity freshwater [CTUe]	4,9E-05	3,8E-05	8,6E-05	1,4E-05
Eutrophication freshwater [kg P eq.]	3,4E-05	3,0E-05	2,4E-05	1,9E-05
Eutrophication marine [kg N eq.]	9,1E-05	5,8E-05	7,8E-05	4,3E-05
Eutrophication terrestrial [Mole of N eq.]	1,8E-04	1,2E-04	1,5E-04	8,7E-05
Ionising radiation - human health [kBq U23	1,6E-04	1,1E-04	1,9E-04	1,6E-04
Land Use [Pt]	2,0E-05	1,4E-05	2,3E-05	1,5E-05
Non-cancer human health effects [CTUh]	6,3E-04	3,7E-04	8,2E-04	1,4E-04
Ozone depletion [kg CFC-11 eq.]	9,5E-07	2,2E-06	2,5E-06	6,5E-07
Photochemical ozone formation - human health [kg NMVOC eq.]	2,8E-04	1,8E-04	3,5E-04	1,3E-04
Resource use, energy carriers [MJ]	1,9E-03	1,2E-03	1,8E-03	1,2E-03
Resource use, mineral and metals [kg Sb	4,2E-03	2,3E-03	3,9E-03	9,0E-04
Respiratory inorganics [kg PM2.5 eq.]	8,1E-04	6,3E-04	2,4E-03	3,6E-04
Water scarcity [m³ world equiv.]	1,7E-04	1,3E-04	1,9E-04	7,5E-05

Single overall score

Required under EF

- Benefits
  -
  -
  -
  -
- Downside
  -
  -
  -
  -

Interpretation of EF results - Hotspots

» The user of the EF method shall identify and list in the EF report (together with the %) the most relevant:

- **Impact categories,**
- **Life cycle stages,**

Relevant for Communication

- **Processes and**
- **Elementary flows.**

Relevant for engineers and designers

Interpretation of EF results - Hotspots

Item	At what level does relevance need to be identified?	Threshold
Most relevant impact categories	Normalised and weighted results	Impact categories contributing cumulatively at least 80% of the total environmental impact
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 (along the entire life cycle) more than 80% to that impact category, considering absolute values.
Most relevant elementary flows	For each most relevant process and most relevant impact categories	All elementary flows contributing cumulatively at least to 80% to the total impact for each most relevant process. If disaggregated data are available: for each most relevant process, all direct elementary flows contributing cumulatively at least to 80% to that impact category (caused by the direct elementary flows only)

Group Work

Exercise – Identification of hotspots

- Perform hotspot analysis on a given set of results following the PEF Method
  - Results are taken from the IT Storage PEF Pilot
- Evaluate most relevant impact categories, life cycle stages and processes
- Discuss

Exercise – Most relevant impact categories

» Calculate and select most relevant impact categories following guidance in PEF Method

Impact Categories (normalized and weighted)	Raw material acquisition and pre-processing	Production of the main product	Product distribution and storage	Use stage	End-of-life	Total
Acidification terrestrial and freshwater	4,96E-03	1,14E-04	5,77E-05	1,81E-02	-9,93E-04	2,22E-02
Climate Change	1,82E-02	9,10E-04	2,14E-04	1,43E-01	-3,75E-03	1,59E-01
Climate Change (biogenic)	-4,89E-06	3,17E-06	3,78E-07	4,98E-04	6,42E-06	5,03E-04
Climate Change (fossil)	1,82E-02	9,06E-04	2,12E-04	1,43E-01	-3,76E-03	1,58E-01
Climate Change (land use change)	1,98E-05	8,05E-07	1,54E-06	1,27E-04	-3,79E-06	1,45E-04
Eutrophication freshwater	6,81E-05	7,68E-07	5,47E-07	1,21E-04	-1,61E-05	1,74E-04
Eutrophication marine	7,59E-04	2,07E-05	2,55E-05	3,26E-03	-1,49E-04	3,92E-03
Eutrophication terrestrial	1,60E-03	4,22E-05	5,53E-05	6,66E-03	-3,11E-04	8,05E-03
Ionising radiation - human health	2,47E-04	1,70E-04	2,68E-07	2,67E-02	-3,04E-05	2,70E-02
Land Use	1,71E-04	1,47E-05	5,23E-06	2,31E-03	-3,56E-05	2,47E-03
Ozone depletion	1,38E-07	3,45E-08	5,21E-11	5,42E-06	-9,28E-08	5,50E-06
Photochemical ozone formation - human health	2,47E-03	6,42E-05	5,48E-05	1,01E-02	-5,02E-04	1,22E-02
Resource use. energy carriers	9,97E-03	7,47E-04	1,39E-04	1,18E-01	-2,00E-03	1,26E-01
Resource use. mineral and metals	7,23E-02	1,44E-05	6,07E-07	4,83E-03	-2,01E-02	5,70E-02
Respiratory inorganics	7,69E-03	1,46E-04	2,67E-05	2,31E-02	-1,97E-03	2,89E-02
Water scarcity	2,91E-03	3,47E-05	2,25E-06	5,60E-03	-3,08E-04	8,24E-03

Exercise – Most relevant life cycle stages

» Calculate and select most relevant life cycle stages following guidance in PEF Method

Impact Categories (characterized, only absolute numbers)	Raw material acquisition and pre-processing	Production of the main product	Product distribution and storage	Use stage	End-of-life	Total
Acidification terrestrial and freshwater [Mole of H+ eq.]	4,15E-02	9,57E-04	4,82E-04	1,51E-01	8,94E-03	2,03E-01
Climate Change [kg CO2 eq.]	6,36E+00	3,18E-01	7,48E-02	5,01E+01	1,55E+00	5,84E+01
Climate Change (biogenic) [kg CO2 eq.]	8,81E-03	1,11E-03	1,32E-04	1,74E-01	3,81E-03	1,88E-01
Climate Change (fossil) [kg CO2 eq.]	6,36E+00	3,17E-01	7,41E-02	4,99E+01	1,55E+00	5,82E+01
Climate Change (land use change) [kg CO2 eq.]	6,91E-03	2,82E-04	5,40E-04	4,43E-02	1,80E-03	5,39E-02
Eutrophication freshwater [kg P eq.]	5,89E-05	6,64E-07	4,72E-07	1,05E-04	1,48E-05	1,79E-04
Eutrophication marine [kg N eq.]	6,89E-03	1,87E-04	2,31E-04	2,96E-02	1,60E-03	3,85E-02
Eutrophication terrestrial [Mole of N eq.]	7,24E-02	1,91E-03	2,50E-03	3,02E-01	1,68E-02	3,95E-01
Ionising radiation - human health [kBq U235 eq.]	1,96E-01	1,33E-01	2,11E-04	2,10E+01	4,40E-02	2,13E+01
Land Use [Pt]	2,70E+01	2,32E+00	8,26E-01	3,65E+02	7,12E+00	4,03E+02
Ozone depletion [kg CFC-11 eq.]	4,79E-10	1,20E-10	1,80E-13	1,88E-08	3,39E-10	1,97E-08
Photochemical ozone formation - human health [kg NMVOC eq.]	1,97E-02	5,11E-04	4,36E-04	8,07E-02	4,54E-03	1,06E-01
Resource use. energy carriers [MJ]	7,31E+01	5,47E+00	1,02E+00	8,60E+02	1,66E+01	9,56E+02
Resource use. mineral and metals [kg Sb eq.]	5,18E-04	1,03E-07	4,35E-09	3,46E-05	1,44E-04	6,97E-04
Respiratory inorganics [Disease Incidence]	5,14E-07	9,72E-09	1,78E-09	1,54E-06	1,37E-07	2,20E-06
Water scarcity [m³ world equiv.]	3,71E+00	4,42E-02	2,86E-03	7,13E+00	4,48E-01	1,13E+01

Exercise – Most relevant processes

» Calculate and select most relevant processes following guidance in PEF Method

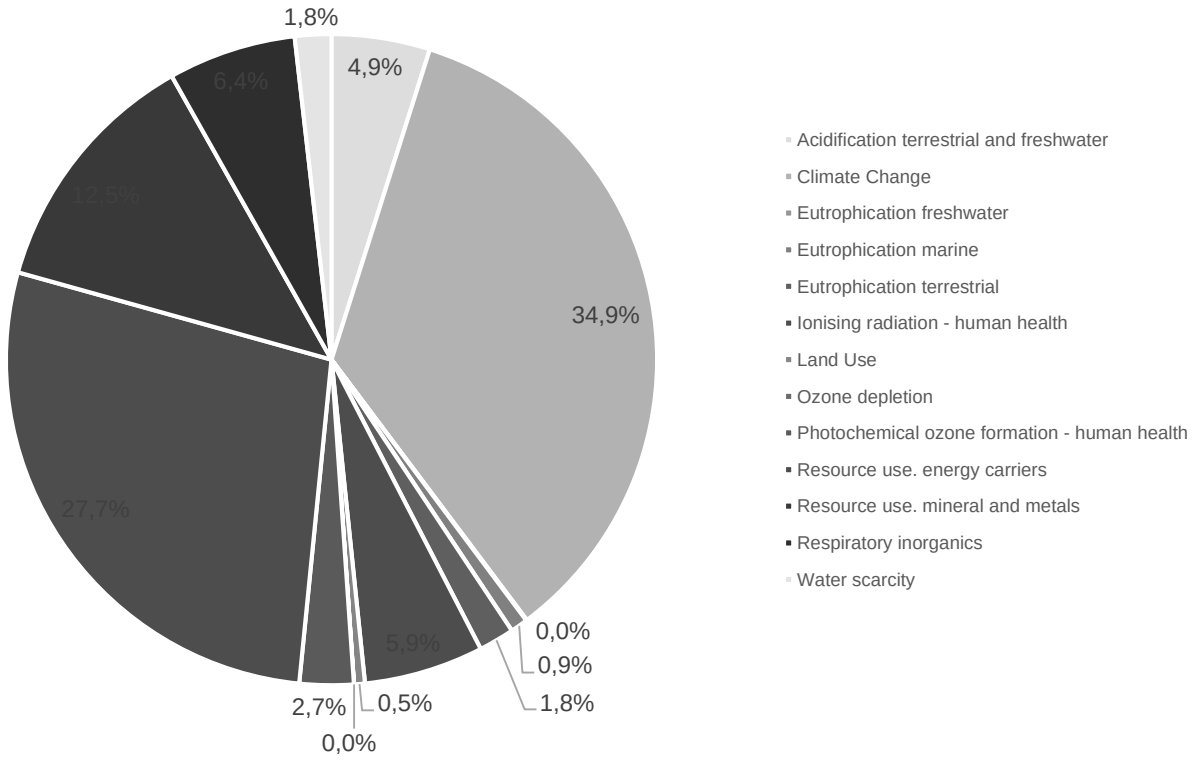
Climate Change [kg CO2 eq.]	Raw material acquisition and pre-processing	Production of the main product	Product distribution and storage	Use stage	End-of-life	Total
Process 1				41		41
Process 2	2					2
Process 3	1,3				-0,8	0,5
Process 4	1,5					1,5
Process 5		0,15				0,15

Result – Most relevant impact categories

» Calculate and select most relevant impact categories following guidance in PEF Method

Impact Categories (normalized and weighted)	Total	Contribution
Acidification terrestrial and freshwater	2,22E-02	4,9%
Climate Change	1,59E-01	34,9%
Climate Change (biogenic)	5,03E-04	
Climate Change (fossil)	1,58E-01	
Climate Change (land use change)	1,45E-04	
Eutrophication freshwater	1,74E-04	0,0%
Eutrophication marine	3,92E-03	0,9%
Eutrophication terrestrial	8,05E-03	1,8%
Ionising radiation - human health	2,70E-02	5,9%
Land Use	2,47E-03	0,5%
Ozone depletion	5,50E-06	0,0%
Photochemical ozone formation - human health	1,22E-02	2,7%
Resource use. energy carriers	1,26E-01	27,7%
Resource use. mineral and metals	5,70E-02	12,5%
Respiratory inorganics	2,89E-02	6,4%
Water scarcity	8,24E-03	1,8%
Single Score	**4,55E-01**	**100%**

1. Calculate single score
2. Calculate shares and select impact categories that cumulatively contribute to at least 80% to the total impact



Results – Most relevant life cycle stages

1. Select most relevant life cycle stages only for most relevant impact categories
2. Calculate shares and select life cycle stages that contribute to at least 80% to the selected impact categories

Impact Categories (characterized, only absolute numbers)	Raw material acquisition and pre-processing	Production of the main product	Product distribution and storage	Use stage	End-of-life	Total
Climate Change	10,9%	0,5%	0,1%	85,8%	2,7%	100,0%
Resource use. energy carriers	7,6%	0,6%	0,1%	90,0%	1,7%	100,0%
Resource use. mineral and metals	74,3%	0,0%	0,0%	5,0%	20,7%	100,0%
Respiratory inorganics	23,3%	0,4%	0,0%	62,9%	4,0%	100,0%

» Use phase accounts for more than 50% of the total impact

→ Repeat procedure excluding use phase

Results – Most relevant life cycle stages

1. Select most relevant life cycle stages only for most relevant impact categories

2. Calculate shares and select life cycle stages that contribute to at least 80% to the selected impact categories, excluding use phase

Impact Categories (characterized, only absolute numbers)	Raw material acquisition and pre-processing	Production of the main product	Product distribution and storage	Use stage	End-of-life	Total
Climate Change	76,6%	3,8%	0,9%		18,7%	100,0%
Resource use. energy carriers	76,0%	5,7%	1,1%		17,2%	100,0%
Resource use. mineral and metals	78,2%	0,0%	0,0%		21,8%	100,0%
Respiratory inorganics	77,6%	1,5%	0,3%		20,7%	100,0%

Results – Most relevant processes

1. Select most relevant processes only for most relevant impact categories
2. Calculate shares and select processes that contribute to at least 80% to the selected impact categories, excluding use phase

Step 1: Deal with negative numbers and calculate total contributions per process

Climate Change [kg CO2 eq.]	Raw material acquisition and pre-processing	Production of the main product	Product distribution and storage	Use stage	End-of-life	Total	% per process
Process 1				41		41	87,7%
Process 2	2					2	4,3%
Process 3	1,3				0,8	0,5	4,5%
Process 4	1,5					1,5	3,2%
Process 5		0,15				0,15	0,3%
Total						45,15	100%

Results – Most relevant processes

Step 2: Calculate and select most relevant processes among complete life cycle

Climate Change	Raw material acquisition and pre-processing	Production of the main product	Product distribution and storage	Use stage	End-of-life	Total [kg CO2 eq.]	% per process
Process 1				87,7%		41	87,7%
Process 2	4,3%					2	4,3%
Process 3	2,8%				1,7%	0,5	4,5%
Process 4	3,2%					1,5	3,2%
Process 5		0%				0,15	0,3%
Total						45,15	100%

» Use phase accounts for more than 50% of the total impact

→ Repeat procedure excluding use phase

Results – Most relevant processes

Step 3: Remove use phase from results and re-calculate total contribution per process

Climate Change [kg CO2 eq.]	Raw material acquisition and pre-processing	Production of the main product	Product distribution and storage	Use stage	End-of-life	Total	% per process
Process 1						0	0%
Process 2	2					2	34,8%
Process 3	1,3				0,8	1,3	36,5%
Process 4	1,5					1,5	26,1%
Process 5		0,15				0,15	2,6%
Total						5,75	100%

Results – Most relevant processes

Step 4: Calculate and select most relevant processes without use phase

Climate Change [kg CO2 eq.]	Raw material acquisition and pre-processing	Production of the main product	Product distribution and storage	Use stage	End-of-life	Total [kg CO2 eq.]	% per process
Process 1						0	0%
Process 2	34,8%					2	34,8%
Process 3	22,6%				13,9	1,3	36,5%
Process 4	26,1%					1,5	26,1%
Process 5		2,6%				0,15	2,6%
Total						5,75	100%

Reporting, Verification and Validation

EF Reporting

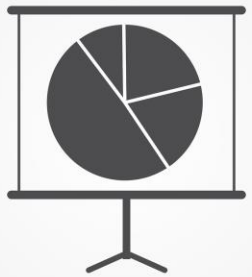
What do you hear/see in the last few hours?

Let’s put an EF report together…

What needs to be reported?

Let’s start a list

Reporting structure



- Summary
- Main report
  - General information,
  - Goal of the study,
  - Scope of the study,
  - Life cycle inventory analysis,
  - Life cycle impact assessment results,
  - Interpreting EF results.
- Aggregated EF compliant dataset (not mandatory)
- Validation statement
- Annexes
- *Possibly: Confidential report (for verification/validation only)*

A PEF/OEF report template is available in Annex E (of the EF Methods). The template **shall** be used.

Verification & Validation

Mandatory whenever the EF study, or part of the information therein, is used for any type of external communication.

Verification:
EF verifier checks whether the EF study has been carried out in compliance with the most updated version of the EF method.

Validation:
EF verifier confirms that the information and data included in the EF study/report and the communication vehicles are reliable, credible and correct.

Verification & Validation (2)

The verification and validation of the EF report shall ensure that:

- the EF report is complete, consistent, and compliant with the EF report template provided in the most recent version of the EF method;
- 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: Confidential information shall be subject to validation, whilst they may be excluded from the EF report.

Verification procedure

1) The commissioner shall select the verifier or verification team following the rules outlined in the EF Methods;
2) The verification shall be performed following the verification process;
3) The verifier shall communicate to the commissioner any misstatements, non-conformities and need for clarifications, and draft the validation statement;
4) The commissioner shall respond to the verifier's comments and introduce necessary corrections and changes (if needed) to ensure the final compliance of the EF study, EF report and technical content of 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;
5) The final validation statement is provided, considering (if needed) the corrections and changes introduced by the commissioner;
6) Surveillance that the EF report is available during the validity of the validation statement.

Verifier

- Single verifier or verification team
- Verifier(s) shall be external to the organisation that conducted the EF study
- Independence of the verifiers shall be guaranteed, i.e. intentions of requirements of ISO/IEC 17020:2012 regarding a 3rd party verifier
- In case the EF study is done based on a PEFCR/OEFSR, verifiers shall not include members of the Technical Secretariat or of the consultants involved in previous parts of the work - screening studies, supporting studies, PEFCR review, etc.

Minimum requirements for verifiers

- *Self declaration*
- *Min. 6 points*
- *Min. 1 point for each mandatory criterion*

			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 method-logy 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
	Know-ledge of the specific sector	Years of experience (5)	<1	1 ≤ x < 3	3 ≤ x < 6	6≤ x < 10	≥10
Additional criteria	Review, verifica-tion/ 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				

Verification / validation

Combination of

- Documental review
  - EF report
  - technical content of any communication vehicle and
  - the data used in the calculations
- Model review

Note:

The verification of the company-specific data shall always be organised through a visit of the production site(s) the data refer to.

The verification may take place at the end of the EF study or in parallel (concurrent) to the study.

Minimum requirements for verification / validation

Correct version of all impact assessment methods and characterization factors

Cut-offs conform with EF requirements

All newly created datasets are EF compliant

Aggregated EF compliant dataset of the product/sector is made available to EC

For ≥ 70% of the most relevant processes (by number) in situation 2 option 2 of the DNM, 70% of underlying numbers shall be validated, including all energy and transpot subprocesses

For ≥ 60% of the most relevant processes (by number) in situation 3 of the DNM, 60% of underlying numbers shall be validated

For ≥ 50% of the other processes (by number) in situation 1, 2 and 3 of the DNM, 50% of the underlying data shall be validated.

For all processes to be validated, it shall be checked if the DQR satisfies the minimum DQR as specified in the EF method

Validity and validity check

The maximum validity should not exceed three years starting from their first issue date.

During validity, agreement must be in place (commissioner and verifier) for periodic checks on:

- bill of material/ bill of components;
- energy mix used for processes in situation 1 of the Data Needs Matrix;
- change of packaging;
- changes in the suppliers (materials/ geography);
- changes in the logistics;
- relevant technological changes in the processes in situation 1 of the Data Needs Matrix.

Questions,
Summary and Wrap Up

Thank you for your attention!

Note: The opinions expressed during the training are those of the contractors only and do not represent the EU's official position