# Product Environmental Footprint Category Rules (PEFCR) for still and sparkling wine

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# Acronyms

| | |
|---|---|
| **AF** | Allocation Factor |
| **AR** | Allocation Ratio |
| **B2B** | Business to Business |
| **B2C** | Business to Consumer |
| **BiB** | Bag in box |
| **BoC** | Bill of Components |
| **BoM** | Bill of Materials |
| **BP** | Bonne Pratique |
| **CF** | Characterization Factor |
| **CFF** | Circular Footprint Formula |
| **CFF-M** | Circular Footprint Formula – Modular form |
| **CMWG** | Cattle Model Working Group |
| **CPA** | Classification of Products by Activity |
| **DC** | Distribution Centre |
| **DMI** | Dry Matter Intake |
| **DNM** | Data Needs Matrix |
| **DQR** | Data Quality Rating |
| **EA** | Economic Allocation |
| **EC** | European Commission |
| **EF** | Environmental Footprint |
| **EI** | Environmental Impact |
| **EoL** | End-of-Life |
| **FU** | Functional Unit |
| **GE** | Gross Energy intake |
| **GHG** | Greenhouse Gas |
| **GR** | Geographical Representativeness |
| **GWP** | Global Warming Potential |
| **HD** | Helpdesk |
| **ILCD** | International Reference Life Cycle Data System |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **ISO** | International Organisation for Standardisation |
| **JRC** | Joint Research Centre |
| **LCA** | Life Cycle Assessment |
| **LCDN** | Life Cycle Data Network |
| **LCI** | Life Cycle Inventory |
| **LCIA** | Life Cycle Impact Assessment |
| **LT** | Lifetime |
| **NACE** | Classification of Economic Activities |
| **NDA** | Non Disclosure Agreement |
| **NGO** | Non-Governmental Organisation |
| **NMVOC** | Non-methane volatile compounds |
| **P** | Precision |
| **PCR** | Product Category Rules |
| **PDO** | Protected Designation of Origin |
| **PEF** | Product Environmental Footprint |
| **PEFCR** | Product Environmental Footprint Category Rules |
| **PGI** | Protected Geographical Indication |
| **RF** | Reference Flow |
| **RP** | Representative Product |

| | |
|---|---|
| **SB** | System Boundary |
| **SC** | Steering Committee |
| **SMRS** | Sustainability Measurement & Reporting System |
| **SOM** | Soil Organic Matter |
| **SS** | Supporting study |
| **TAB** | Technical Advisory Board |
| **TeR** | Technological Representativeness |
| **TiR** | Time Representativeness |
| **TS** | Technical Secretariat |
| **UNEP** | United Nations Environment |
| **UUID** | Universally Unique Identifier |

## Definitions

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

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

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

**Benchmark** – A standard or point of reference against which any comparison can be made. In the context of PEF, the term 'benchmark' refers to the *average* environmental performance of the representative product sold in the EU market. A benchmark may eventually be used, if appropriate, in the context of communicating environmental performance of a product belonging to the same category.

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

[1] Based on GHG protocol scope 3 definition from the Corporate Accounting and Reporting Standard (World resources institute, 2011).
[2] Source: UNEP/SETAC "Global Guidance Principles for LCA Databases"

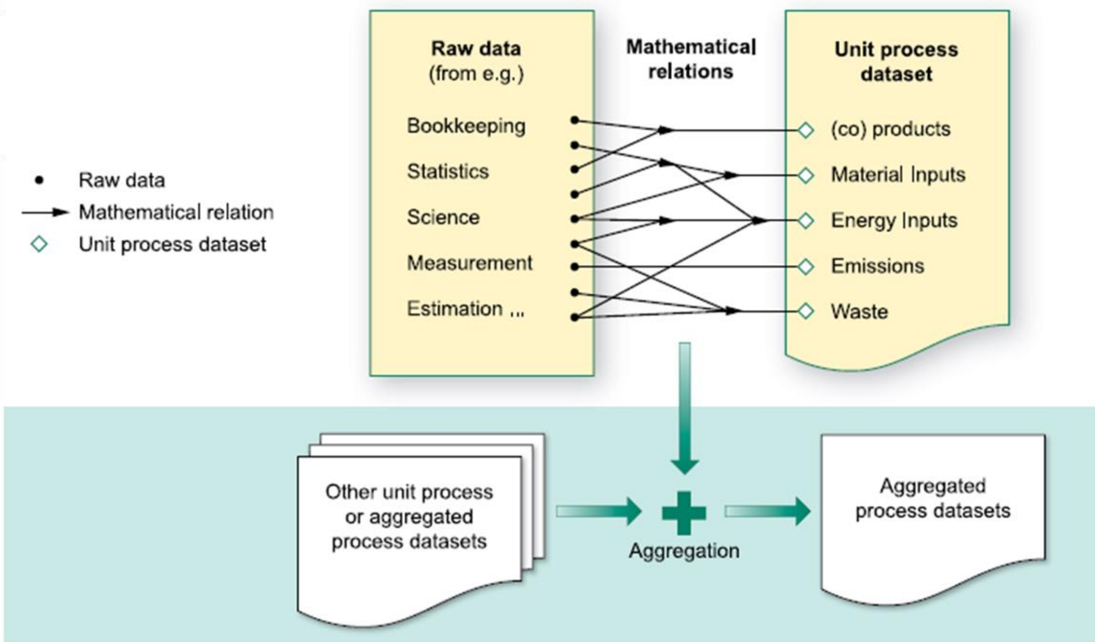


**Figure 1: Definition of a unit process dataset and an aggregated process dataset**

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

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

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

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

**Comparative assertion** – An environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function (adapted from ISO 14025:2006).

**Comparison** – A comparison, not including a comparative assertion, (graphic or otherwise) of two or more products based on the results of a PEF study and supporting PEFCRs or the comparison of one or more products against the benchmark, based on the results of a PEF study and supporting PEFCRs.

**Data Quality Rating (DQR)** - Semi-quantitative assessment of the quality criteria of a dataset based on Technological representativeness, Geographical representativeness, Time-related representativeness, and Precision. The data quality shall be considered as the quality of the dataset as documented.

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

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

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

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

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

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

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

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

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

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

[3] https://ec.europa.eu/energy/intelligent/projects/en/projects/e-track-ii

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

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

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

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

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

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

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

**Oenological practices** – Oenological practices are the treatments and substances (both additives and processing aids) permitted for the production of wine. Permitted oenological practices are strictly regulated by the EU wine legislation in the form of a positive list; see Regulation 606/2009 laying down certain detailed rules for implementing Council Regulation (EC) No 479/2008 as regards the categories of grapevine products, oenological practices and the applicable restrictions.

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

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

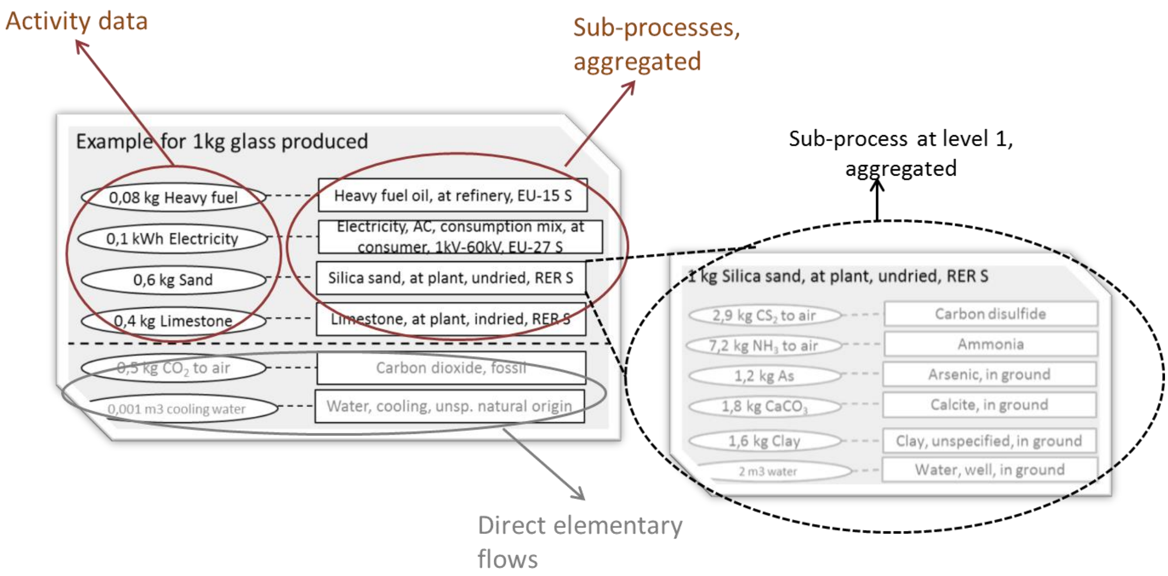


**Figure 2: An example of a partially aggregated dataset, at level 1. The activity data and direct elementary flows are to the left, and the complementing sub-processes in their aggregated form are to the right. The grey text indicates elementary flows**

**PEFCR Supporting study** - The PEF study done on the basis of a draft PEFCR. It is used to confirm the decisions taken in the draft PEFCR before the final PEFCR is released.

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

**PEF screening** – A preliminary study carried out on the representative product(s) and intended to identify the most relevant life cycle stages, processes, elementary flows, impact categories and data quality needs to derive the preliminary indication about the definition of the benchmark for the product category/sub-categories in scope, and any other major requirement to be part of the final PEFCR.

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

**Practitioner of the EF study** – Individual, organisation or group of organisations that performs the EF study in accordance with the PEF Guide, PEFCR Guidance and the relevant PEFCR if available. The practitioner of the EF study can belong to the same organisation as the commissioner of the EF study (adapted from ISO 14071/2014, point 3.6).

**Primary data**[4] - This term refers to data from specific processes within the supply-chain of the company applying the PEFCR. Such data may take the form of activity data, or foreground

[4] Based on GHG protocol scope 3 definition from the Corporate Accounting and Reporting Standard (World resources institute, 20011).

elementary flows (life cycle inventory). Primary data are site-specific, company-specific (if multiple sites for the same product) or supply-chain-specific. Primary data may be obtained through meter readings, purchase records, utility bills, engineering models, direct monitoring, material/product balances, stoichiometry, or other methods for obtaining data from specific processes in the value chain of the company applying the PEFCR. In this Guidance, primary data is synonym of "company-specific data" or "supply-chain specific data".

**Product category** – Group of products (or services) that can fulfil equivalent functions (ISO 14025:2006).

**Product Category Rules (PCR)** – Set of specific rules, requirements and guidelines for developing Type III environmental declarations for one or more product categories (ISO 14025:2006).

**Product Environmental Footprint Category Rules (PEFCRs)** – Product category-specific, life-cycle-based rules that complement general methodological guidance for PEF studies by providing further specification at the level of a specific product category. PEFCRs help to shift the focus of the PEF study towards those aspects and parameters that matter the most, and hence contribute to increased relevance, reproducibility and consistency of the results by reducing costs versus a study based on the comprehensive requirements of the PEF guide.

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

**Representative product (model)** - The "representative product" may or may not be a real product that one can buy on the EU market. Especially when the market is made up of different technologies, the "representative product" can be a virtual (non-existing) product built, for example, from the average EU sales-weighted characteristics of all technologies around. A PEFCR may include more than one representative product if appropriate.

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

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

**Secondary data**[5] - It refers to data not from specific process within the supply-chain of the company applying the PEFCR. This refers to data that is not directly collected, measured, or

[5] Based on GHG protocol scope 3 definition from the Corporate Accounting and Reporting Standard (World resources institute, 20011)

estimated by the company, but sourced from a third party life-cycle-inventory database or other sources. Secondary data includes industry-average data (e.g., from published production data, government statistics, and industry associations), literature studies, engineering studies and patents, and can also be based on financial data, and contain proxy data, and other generic data. Primary data that go through a horizontal aggregation step are considered as secondary data.

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

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

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

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

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

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

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

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

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

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

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

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

# 1 Introduction

The Product Environmental Footprint (PEF) Guide provides detailed and comprehensive technical guidance on how to conduct a PEF study. PEF studies may be used for a variety of purposes, including in-house management and participation in voluntary or mandatory programmes.

For all requirements not specified in this PEFCR the applicant shall refer to the documents this PEFCR is in conformance with (see chapter 2.7).

The compliance with the present PEFCR is optional for PEF in-house applications, whilst it is mandatory whenever the results of a PEF study or any of its content is intended to be communicated.

**Terminology: shall, should and may**

This PEFCR uses precise terminology to indicate the requirements, the recommendations and options that could be chosen when a PEF study is conducted.

- The term “shall” is used to indicate what is required in order for a PEF study to be in conformance with this PEFCR.
- The term “should” is used to indicate a recommendation rather than a requirement. Any deviation from a “should” requirement has to be justified when developing the PEF study and made transparent.
- The term “may” is used to indicate an option that is permissible. Whenever options are available, the PEF study shall include adequate argumentation to justify the chosen option.

# 2 General information about the PEFCR

## 2.1. Technical secretariat

| ***Name of the organization*** | ***Type of organization*** | ***Name of the members*** | ***Participation since*** |
|---|---|---|---|
| Comité Européen des Entreprises Vins (CEEV) (Coordinator) | Industry | Aurora Abad<br>Ignacio Sánchez | July 2014 |
| Pernod Ricard Winemakers Spain | Industry | Ainhoa Peña | July 2014 |
| Comité Interprofessionnel du Vin de Champagne (CIVC) and three Champagne producers represented by CIVC | Industry | Pierre Naviaux | July 2014 |
| Unione Italiana Vini (UIV) | Industry | Stefano Stefanucci | July 2014 |
| Soc. Agr. Salcheto | Industry | Michele Manelli | July 2014 |
| The European Container Glass Federation (FEVE) | Industry | Adeline Farrelly | July 2014 |
| Amcor | Industry | Gerald Rebitzer<br>Isabelle Jenny | July 2014 |
| Nomacorc | Industry | Olav Aagaard | July 2014 |
| C.E. Liège | Industry | Joao Ferreira<br>Ana Dias | July 2014 |
| IHOBE – Public agency of environment of the Basque Government | Public body | José María Fernández Alcalá | July 2015 |
| Institut Français de la Vigne et du Vin (IFV) | Academia | Sophie Penavayre | July 2015 |
| Lavola | Consultant | Cristina Gazulla | July 2014 |
| Ecole supérieure d'agricultures (ESA) - Angers | Academia | Christel Renaud-Gentié | September 2015 |

## 2.2. Consultations and stakeholders

The procedure for the development of this PEFCR draft includes a number of consultation steps:

***1st public stakeholder (scope and representative product and assessment of the alignment of existing Product Category Rules)***

- Opened from November 25th 2014 to December, 21st 2014
- 150 comments received from the following organizations:
    - Amcor
    - Bayer
    - C.E.Liège
    - Csányi Winery Ltd
    - ESCI
    - Heineken
    - IAT
    - IMA- Europe
    - IMELS – Italian Ministry for the Environment, Land and Sea
    - Nomacorc
    - RDC (Technical Helpdesk)
    - The Brewers of Europe (Beer PEF Pilot)
    - The International EPD System
    - University Cattolica del Sacro Cuore of Piacenza
    - Wine Institute

***2nd public consultation (screening and draft PEFCR)***

- Opened from December 30th 2015 – January 30th 2016
- 103 comments received from the following organizations:
    - ADEME
    - Belgian Federal Ministry of public Health and Environment
    - C.E.Liege
    - ENEA
    - FEVE
    - IMELS – Italian Ministry for the Environment, Land and Sea
    - The Alliance for Beverage Cartons and the Environment (ACE)
    - The EPD International System
    - Università Cattolica

***3rd public consultation (draft PEFCR)***

- Opened from July 29th 2016 – September 9th 2016
- 103 comments received from the following organizations:
    - ADEME
    - ASSOVETRO
    - British Glass
    - Catalan Institute of Cork
    - CE Delft
    - DG ENV – European Commission

- ENEA
- European Cork Federation
- FEVE
- FIVS
- Francisco Oller, SA
- Italian Ministry of Environment
- MEEM
- Miguel Torres, S.A.
- Pernod Ricard
- Sevenster Environmental
- SOLTUB Ltd. Hungary
- Vinventions LLC

All stakeholders registered in the wine pilot were able to take part in the consultation through the web page related to the PEFCR Wine development: https://webgate.ec.europa.eu/fpfis/wikis/display/EUENVFP/PEFCR+Pilot%3A+Wine

## 2.3. Review panel and review requirements of the PEFCR

| ***Name of the member*** | ***Affiliation*** | ***Role*** |
|---|---|---|
| Dr. Yolanda Núñez | Centro Tecnológico Miranda de Ebro (CTME) | LCA and wine expert<br>Chair of the panel |
| Ana de la Puente | Ingurumenaren Kideak Ingenieria, S.L. | LCA and wine expert |
| Ugo Pretato | Studio Fieschi & soci Srl | LCA and wine expert |

The reviewers have verified that the following requirements have been fulfilled:

- The PEFCR has been developed in accordance with the requirement provided in the PEFCR Guidance 6.3, and where appropriate in accordance with the requirements provided in the most recent approved version of the PEF Guide, and supports creation of credible and consistent PEF profiles,
- The functional unit, allocation and calculation rules are adequate for the product category under consideration,
- Company-specific and secondary datasets used to develop this PEFCR are relevant, representative, and reliable,
- The selected LCIA indicators and additional environmental information are appropriate for the product category under consideration and the selection is done in accordance with the guidelines stated in the PEFCR Guidance version 6.3 and the most recent approved version of the PEF Guide,

- The benchmark(s) is(are) correctly defined, and
- Both LCA-based data and the additional environmental information prescribed by the PEFCR give a description of the significant environmental aspects associated with the product.

The detailed review report is provided in Annex 3 of this PEFCR.

## 2.4. Review statement

This PEFCR has been developed in compliance with Version 6.3 of the PEFCR Guidance, and with the PEF Guide adopted by the Commission on April 2013.

The representative products correctly describe the average products sold in Europe for the product group in scope of this PEFCR.

PEF studies carried out in compliance with this PEFCR would reasonably lead to reproducible results and the information included therein may be used to make comparisons and comparative assertions under the prescribed conditions (see chapter on limitations).

The panel members confirm that they have sufficient knowledge and experience on the sector involved and on the relevant methods and guidance to carry out this review and that they have performed the review tasks at the best of their capacity.

The panel members also confirm that they have been independent in their role as reviewers, they have not been involved in the development of the PEFCR and they do not have conflicts of interest regarding this review.

Overall, the Wine PEFCR Review Panel found the quality of this document adequate for providing general guidance and defining the requirements for PEF studies for still and sparkling wine.

## 2.5. Geographic validity

This PEFCR is valid for products in scope sold/consumed in the European Union + EFTA.

Each PEF study shall identify its geographical validity listing all the countries where the product object of the PEF study is consumed/sold with the relative market share. In case the information on the market for the specific product object of the study is not available, Europe +EFTA shall be considered as the default market, with an equal market share for each country.

## 2.6. Language

The PEFCR is written in English. The original in English supersedes translated versions in case of conflicts.

## 2.7. Conformance to other documents

This PEFCR has been prepared in conformance with the following documents (in prevailing order):

- PEFCR Guidance 6.3.
- Product Environmental Footprint (PEF) Guide; Annex II to the Recommendation 2013/179/EU, 9 April 2013. Published in the official journal of the European Union Volume 56, 4 May 2013

# 3 PEFCR scope

This PEFCR covers all wine subcategories:

- **Still wine**: the product obtained exclusively from the total or partial alcoholic fermentation of fresh grapes or of grape must. Wine shall have a minimum actual alcoholic strength and specific minimum limits are settled for different wine-growing zones.
- **Sparkling wine**: obtained by first or second alcoholic fermentation from fresh grapes, from grape must or from wine and which, when the container is opened, releases carbon dioxide derived exclusively from fermentation. It includes quality sparkling wine, quality aromatic sparkling wine, aerated sparkling wine, semi-sparkling wine and aerated semi-sparkling wine.

## 3.1. Product classification

The CPA code for the products included in this PEFCR is: “11.02 –manufacture of wine from grape”, including:

- Manufacture of wine,
- Manufacture of sparkling wine,
- Manufacture of wine from concentrated grape must,
- Blending, purification and bottling of wine, and
- Manufacture of low or non-alcoholic wine.

This CPA/NACE class does not totally fit with the product category definition, as it includes manufacture of “non-alcoholic wine” whereas according to Regulation 1308/2013 wine shall have minimum alcohol strength.

On the other hand, CPA/NACE class 11.02 excludes merely bottling and labelling of wine. However, this PEFCR tackles all environmentally relevant activities in the life cycle of the product.

## 3.2. Representative product(s)

The representative wines are **virtual products** defined according to available average data on:

- Types of wine consumed in the EU (red, white and rosé; still and sparkling; organic and non-organic).
- Quantity of grapes and oenological products consumed.
- Quantity and type of co-products produced.
- Origin of the still wine and sparkling wine consumed in the EU.
- Use of different types of packaging.
- General recommendations about serving temperatures.

The virtual representative products are defined as follows:

- Still wine:
    - Wine-making: 63.55% red conventional, 4.45% red organic, 29.9% white conventional and 2.1% white organic.
    - Ageing in oak barrels (for at least 12 months): 15% of still red glass-bottled wine and 3% of still white glass-bottled wine.
    - Primary packaging: 79% of glass bottle (with different types of stoppers), 16% of Bag in Box, 4% of PET bottle and 1% of beverage carton.
    - Types of stoppers used for glass bottles: 67% cork closure, 17% synthetic stoppers (made of a mix of materials) and 16% screw caps (made of aluminium).
    - Production: 75% in the EU, 25% abroad.
- Sparkling wine:
    - Wine-making: 93.45% conventional and 6.55% organic.
    - Primary packaging: glass bottle and mushroom-shaped sparkling wine closure.
    - Production: 97% in the EU, 3% abroad.

The screening study is available upon request to the TS coordinator that has the responsibility of distributing it with an adequate disclaimer about its limitations.

## 3.3. Functional unit and reference flow

The FU is consumption of 0.75 litres of packaged wine. Table 1 defines the key aspects used to define the FU.

**Table 1.** ***Key aspects of the FU***

| | |
|---|---|
| *What?* | Moderate consumption of alcoholic beverage. |
| *How much?* | 0.75 litres of wine |
| *How well?* | This aspect could not be incorporated so far. This limitation is recognized and requires further developments in order to improve fair comparisons. |
| *How long?* | Not applicable as how long refers to the duration/life time of the product and shall be quantified if shelf-life is indicated on the packaging. As wine has a very long shelf life being exempted by Regulation 1168/2011 from a mandatory indication of an expiry date, and the duration of the service provided is very variable. |

The reference flow is the amount of product needed to fulfil the defined function and shall be measured in litres. All quantitative input and output data collected in the study shall be calculated in relation to this reference flow.

This reference flow is applicable to wine products covered by this PEFCR regardless the nominal volume they have been packaged in. Therefore, the amount of the marketed real product needed to fulfil the functional unit will depend on its nominal volume (e.g. 1 bottle of 0.75 litres, 2 bottles of 37.5 centilitres, ¼ parts of a 3 litres bag-in-box, etc.).

## 3.4. System boundary

The system boundaries are described in the Figure 3.

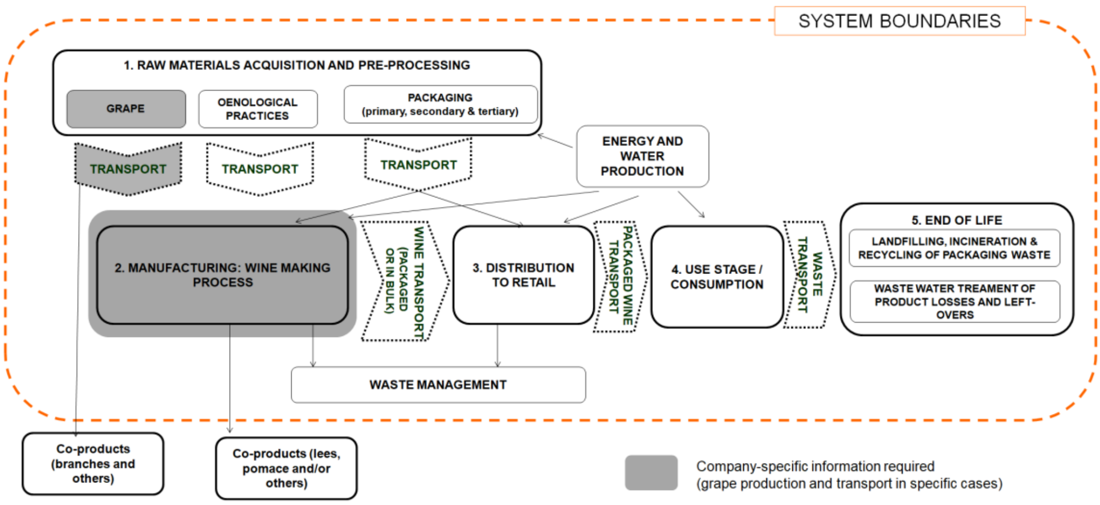


**Figure 3: System diagram for wine**

The following life cycle stages and processes shall be included in the system boundary:

**Table 2. Life cycle stages**

| ***Life cycle stage*** | ***Short description of the processes included*** |
|---|---|
| 1. Raw material acquisition and pre-processing | The life cycle of wine starts with the **cultivation of grapes** which entails different processes related with vine plantation, plants and soil management, grape harvesting and vine destruction.<br><br>This stage entails also the **production of all packaging** used for marketing still or sparkling wine. Packaging of sparkling wine may be part of the production process if the second fermentation occurs in the final bottle, which will need to be washed, labelled and encapsulated.<br>Once produced, still wine may be marketed in bulk or in small size containers for the retail market. Therefore filling operations may be carried out by the same winery producing the wine or by others. Different volumes and packaging options may be used for still wine, whereas sparkling wine shall be |

| | |
|---|---|
| | marketed in a specific type of glass bottles and mushroom-shaped sparkling wine closure[6].<br>Finally, within this stage the **production of oenological practices** used during wine making is also included as well as the **transportation of all inputs** from supplier to producer. |
| 2. Manufacturing stage: wine making process | Once at the winery, grapes are weighed, classified and usually crushed to liberate the juice without squashing the seeds. At this point, two co-products are obtained: grape must (used to make the wine) and grape pomace that derivates to the distillation industry to produce spirits, industrial alcohol, etc. Grape must may be transported to other wineries or used within the same production site where grapes have been crushed.<br>Then, the vinification process starts and it differs depending mainly on the type of wine: still or sparkling; white, red or rosé, and conventional or organic. Wine making includes different steps such as fermentation, clarification or stabilisation, entailing the use of permitted oenological practices (additives and processing aids) regulated by the EU wine legislation[7] in the form of a positive list. In addition to wine, the wine making process produces lees which are also derivate to the distillation industry. |
| 3. Distribution stage | Packaged or bulk wine is distributed to retail and then from retail to consumer. |
| 4. Use stage: wine consumption | The use stage starts at the moment the end user consumes wine and till the product enters its end-of-life stage.<br>If maintained in the original (adequate) packaging and stored at room temperature, wine does not require chilling for its preservation. However in the case of sparkling and white and rosé wines, serving temperatures are recommended by winemakers to improve consumer's experience, whereas for red wine room temperature is usually considered good enough. In such cases, the product may be cooled in a fridge before serving. |
| 5. End of life | Once the wine is consumed, primary packaging materials are recovered (recycled or energy recovery) or disposed (landfilling or incineration without energy recovery). Waste management of product losses or left-overs shall also be included in this stage. |

According to this PEFCR, the following processes may be excluded based on the cut-off rule: production of capital goods (including building, equipment and machinery).

Each PEF study done in accordance with this PEFCR shall provide in the PEF study a diagram indicating the organizational boundary, to highlight those activities under the control of the organization and those falling into Situation 1, 2 or 3 of the data need matrix.

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[6] Article 69, Regulation 607/2009 laying down certain detailed rules for implementing Council Regulation (EC) No 479/2008 as regards the vineyard register, compulsory declarations and the gathering of information to monitor the wine market.

[7] Regulation 606/2009 laying down certain detailed rules for implementing Council Regulation (EC) No 479/2008 as regards the categories of grapevine products, oenological practices and the applicable restrictions.

## 3.5. EF impact assessment

Each PEF study carried out in compliance with this PEFCR shall calculate the PEF-profile including all PEF impact categories listed in the Table below.

**Table 3. List of the impact categories to be used to calculate the PEF profile**

| Impact category | Indicator | Unit | Recommended default LCIA method |
|---|---|---|---|
| Climate change* | Radiative forcing as Global Warming Potential (GWP100) | kg $CO_{2\ eq}$ | Baseline model of 100 years of the IPCC (based on IPCC 2013) |
| Climate change- biogenic | | | |
| Climate change – land use and land transformation | | | |
| Ozone depletion | Ozone Depletion Potential (ODP) | kg CFC-11 $_{eq}$ | Steady-state ODPs 1999 as in WMO assessment |
| Human toxicity, cancer** | Comparative Toxic Unit for humans ($CTU_h$) | CTUh | USEtox model (Rosenbaum et al, 2008) |
| Human toxicity, non-cancer** | Comparative Toxic Unit for humans ($CTU_h$) | CTUh | USEtox model (Rosenbaum et al, 2008) |
| Particulate matter | Impact on human health | disease incidence | UNEP recommended model (Fantke et al 2016) |
| Ionising radiation, human health | Human exposure efficiency relative to $U^{235}$ | kBq $U^{235}$ $_{eq}$ | Human health effect model as developed by Dreicer et al. 1995 (Frischknecht et al, 2000) |
| Photochemical ozone formation, human health | Tropospheric ozone concentration increase | kg NMVOC $_{eq}$ | LOTOS-EUROS model (Van Zelm et al, 2008) as implemented in ReCiPe |
| Acidification | Accumulated Exceedance (AE) | mol H+ $_{eq}$ | Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008) |
| Eutrophication, terrestrial | Accumulated Exceedance (AE) | mol N $_{eq}$ | Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008) |
| Eutrophication, freshwater | Fraction of nutrients reaching freshwater end compartment (P) | kg P $_{eq}$ | EUTREND model (Struijs et al, 2009b) as implemented in ReCiPe |
| Eutrophication, marine | Fraction of nutrients reaching marine end compartment (N) | kg N $_{eq}$ | EUTREND model (Struijs et al, 2009b) as implemented in ReCiPe |
| Ecotoxicity, freshwater** | Comparative Toxic Unit for ecosystems ($CTU_e$) | CTUe | USEtox model, (Rosenbaum et al, 2008) |
| Land use | • Soil quality index[8]<br>• Biotic production<br>• Erosion resistance<br>• Mechanical | • Dimensionless (pt)<br>• kg biotic production[9]<br>• kg soil<br>• $m^3$ water<br>• m3 groundwater | • Soil quality index based on LANCA (EC-JRC)[10]<br>• LANCA (Beck et al. 2010)<br>• LANCA (Beck et al. 2010)<br>• LANCA (Beck et al. 2010)<br>• LANCA (Beck et al. 2010) |

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

[9] This refers to occupation. In case of transformation the LANCA indicators are without the year (a)

[10] Forthcoming document on the update of the recommended Impact Assessment methods and factors for the EF

| Impact category | Indicator | Unit | Recommended default LCIA method |
|---|---|---|---|
| | filtration<br>• Groundwater replenishment | | |
| Water use*** | User deprivation potential (deprivation-weighted water consumption) | $m^3$ world $_{eq}$ | Available WAter REmaining (AWARE) Boulay et al., 2016 |
| Resource use, minerals and metals | Abiotic resource depletion (ADP ultimate reserves) | kg Sb $_{eq}$ | CML 2002 (Guinée et al., 2002) and van Oers et al. 2002. |
| Resource use, fossils | Abiotic resource depletion – fossil fuels (ADP-fossil) | MJ | CML 2002 (Guinée et al., 2002) and van Oers et al. 2002 |

*The sub-indicators 'Climate change - biogenic' and 'Climate change - land use and land transformation' shall be reported separately because their contribution to the total climate change impact, based on the benchmark results, is more than 5% each.

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

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

The impact category “climate change” shall be broken down in three subcategories:

- Climate change – fossil
- Climate change – biogenic
- Climate change – land use and land transformation

For climate change-biogenic, a simplified modelling approach shall be used, i.e. only “methane (biogenic)” is modelled. Being an upland crop, vineyards are not expected to be a major producer of methane. Soil carbon emissions derived from aboveground residues, such as the application of non-native forest residues or straw shall be modelled under the sub-category climate change – land use and land transformation.

Whereas carbon storage in trees shall be included under climate change – biogenic, soil carbon storage shall be excluded from the footprint results but can be included as additional environmental information (see section 5.10).

The full list of normalization factors and weighting factors are available in Annex 1 - List of EF normalisation factors and weighting factors.

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

The current PEF method includes no impact category named "biodiversity" but at least 6 impact categories have an effect on biodiversity (i.e., climate change, eutrophication aquatic freshwater, eutrophication aquatic marine, acidification, water use, land use). Biodiversity is considered relevant for this PEFCR, see more information in chapter 7.4.2.

## 3.6. Limitations

This PEFCR enables comparison between packed wines exclusively on the basis of the calculated environmental performance related to the Functional Unit. This PEFCR is not meant to support comparison or comparative assertion between packaging materials alone. Once this limitation is taken into account, the PEFCR can be used to compare the global environmental performance of different packed wine products.

When companies applying the PEFCR do not run grape production or have no access to company-specific information, default datasets listed in the excel file named "Wine_PEFCR_v6.3-Life cycle inventory.xlsx" available at http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm shall be applied even though they do not take into account different regions and circumstances.

Whereas some specific inputs are covered by proxies, other elements remain as data gaps and therefore are excluded from the scope of the study (see chapter 5.3.3).

# 4 Most relevant impact categories, life cycle stages and processes

The most relevant impact categories for the sub-categories still wine and sparkling wine in scope of this PEFCR are the ones identified in grey in the following tables.

**Table 4. Most relevant impact categories based on normalised and weighted results, excluding toxicity impact categories**

| | CONTRIBUTION TO THE TOTAL IMPACT (%) | | | |
|---|---|---|---|---|
| | STILL WINE | | SPARKLING WINE | |
| IMPACT CATEGORY | % | Order | % | Order |
| Acidification terrestrial and freshwater | 7% | 5th | 6% | 6th |
| Climate Change | 29% | 1st | 32% | 1st |
| Eutrophication freshwater | 1% | 12th | 1% | 11th |
| Eutrophication marine | 3% | 10th | 2% | 9th |
| Eutrophication terrestrial | 4% | 9th | 3% | 7th |
| Ionising radiation - human health | 1% | 11th | 1% | 10th |
| Land Use | 7% | 6th | 5% | 6th |
| Ozone depletion | 0% | 13th | 0% | 12th |
| Photochemical ozone formation - human health | 4% | 8th | 2% | 8th |
| Resource use, fossils | 17% | 2nd | 19% | 2nd |
| Resource use, mineral and metals | 14% | 3rd | 9% | 4th |
| Particulate matter | 9% | 4th | 8% | 5th |
| Water use | 5% | 7th | 12% | 3rd |

The most relevant life cycle stages for the sub-categories still wine and sparkling wine in scope of this PEFCR are the ones identified in grey in the following tables. As it can be seen, in both cases these stages are: **grape production, wine making and packaging**.

**Table 5. Most relevant life cycle stages for the sub-category still wine**

| IMPACT CATEGORY | Grape production | Wine making | Packaging | Distribution | Consumption | EoL |
|---|---|---|---|---|---|---|
| Acidification terrestrial and freshwater | 42% | 17% | 19% | 16% | 3% | 4% |
| Climate Change | 20% | 20% | 32% | 10% | 5% | 13% |
| Land Use | 75% | 5% | 15% | 4% | 0.4% | 0.5% |
| Resource use, fossils | 18% | 23% | 35% | 6% | 7% | 11% |
| Resource use, mineral and metals | 84% | 4% | 10% | 0% | 0.3% | 2% |
| Particulate matter | 30% | 20% | 29% | 12% | 3% | 7% |

**Table 6. Most relevant life cycle stages for the sub-category sparkling wine**

| IMPACT CATEGORY | Grape production | Wine making | Packaging | Distribution | Consumption | EoL |
|---|---|---|---|---|---|---|
| Acidification terrestrial and freshwater | 36% | 15% | 34% | 2% | 3% | 10% |
| Climate Change | 13% | 15% | 41% | 4% | 4% | 24% |
| Land Use | 68% | 1% | 24% | 4% | 0% | 1% |
| Resource use, fossils | 11% | 18% | 43% | 1% | 5% | 22% |
| Resource use, mineral and metals | 88% | 2% | 7% | 0% | 0% | 4% |
| Water use | 19% | 4% | 34% | 0% | 2% | 41% |

The most relevant processes for the product group in scope of this PEFCR are the following:

**Table 7. List of the most relevant processes for still wine**

| ***Impact category*** | ***Processes*** |
|---|---|
| Climate change | Production of glass container (from life cycle stage packaging) |
| | Electricity production (from life cycle stage wine making) |
| | Plantation/destruction of grafted vine (from life cycle stage grape production) |
| | Substituted virgin glass acquisition and pre-processing (from life cycle stage end of life) |
| | Glass recycling process (from life cycle stage end of life) |
| | Grape full production (from life cycle stage grape production) |
| | Transportation in bulk (from life cycle stage distribution) |
| | Transportation to consumer (from life cycle distribution) |
| | Landfill of wood packaging (from life cycle stage distribution) |
| Resource use, fossils | Production of glass container (from life cycle stage packaging) |
| | Electricity production (from life cycle stage wine making) |
| | Substituted virgin glass acquisition and pre-processing (from life cycle stage end of life) |
| | Plantation/destruction of grafted vine (from life cycle stage grape production) |
| | Transportation to consumer (from life cycle distribution) |
| | Electricity consumption (from life cycle consumption) |
| | Grape full production (from life cycle stage grape production) |
| | Glass recycling process (from life cycle stage end of life) |

| ***Impact category*** | ***Processes*** |
|---|---|
| Resource use, minerals and metals | Plantation/destruction of grafted vine (from life cycle stage grape production) |
| | Grape full production (from life cycle stage grape production) |
| | Ageing in oak barrel (steel) (from life cycle wine making) |
| | PET bottle (from life cycle packaging) |
| | Recycling of PET (from life cycle end of life) |
| Particulate matter | Plantation/destruction of grafted vine (from life cycle stage grape production) |
| | Electricity production (from life cycle stage wine making) |
| | Grape full production (from life cycle stage grape production) |
| | Production of glass container (from life cycle stage packaging) |
| | Substituted virgin glass acquisition and pre-processing (from life cycle stage end of life) |
| | Production of secondary packaging - wood (from life cycle stage distribution) |
| | Transportation in bulk (from life cycle stage distribution) |
| Land use | Grape full production (from life cycle stage grape production) |
| | Secondary packaging (corrugated board) (from life cycle packaging) |
| | EoL secondary packaging (Corrugated board) (from life cycle EoL) |
| Acidification terrestrial and freshwater | Plantation/destruction of grafted vine (from life cycle stage grape production) |
| | Grape full production (from life cycle stage grape production) |
| | Transportation in bulk (from life cycle stage distribution) |
| | Electricity consumption (from life cycle stage wine making) |
| | Production of glass container (from life cycle stage packaging) |
| | Substituted virgin glass acquisition and pre-processing (from life cycle stage end of life) |
| | Glass recycling process (from life cycle stage end of life) |

**Table 8. List of the most relevant processes for sparkling wine**

| ***Impact category*** | ***Processes*** |
|---|---|
| Climate change | Production of glass container (from life cycle stage packaging) |
| | Substituted virgin glass acquisition and pre-processing (from life cycle stage end of |

| ***Impact category*** | ***Processes*** |
| --- | --- |
| | life) |
| | Grape full production (from life cycle stage grape production) |
| | Plantation/destruction of grafted vine (from life cycle stage grape production) |
| | Glass recycling process (from life cycle stage end of life) |
| Resource use, fossils | Production of glass container (from life cycle stage packaging) |
| | Substituted virgin glass acquisition and pre-processing (from life cycle stage end of life) |
| | Glass recycling process (from life cycle stage end of life) |
| | Grape full production (from life cycle stage grape production) |
| | Plantation/destruction of grafted vine (from life cycle stage grape production) |
| Resource use, minerals and metals | Plantation/destruction of grafted vine (from life cycle stage grape production) |
| | Grape full production (from life cycle stage grape production) |
| | Production of glass container (from life cycle stage packaging) |
| Land use | Grape full production (from life cycle stage grape production) |
| | Secondary packaging (corrugated board) (from life cycle packaging) |
| Respiratory inorganics | Production of glass container (from life cycle stage packaging) |
| | Plantation/destruction of grafted vine (from life cycle stage grape production) |
| | Electricity consumption (from life cycle stage wine making) |
| | Grape full production (from life cycle stage grape production) |
| | Secondary packaging – pallet (from life cycle stage packaging) |
| | Substituted virgin glass acquisition and pre-processing (from life cycle stage end of life) |
| | Glass recycling process (from life cycle stage end of life) |
| Water use | Production of glass container (from life cycle stage packaging) |
| | Substituted virgin glass acquisition and pre-processing (from life cycle stage end of life) |
| | Glass recycling process (from life cycle stage end of life) |
| | Plantation/destruction of grafted vine (from life cycle stage grape production) |

# 5 Life cycle inventory

All newly created processes shall be EF-compliant.

Sampling is allowed for the collection of primary data. In case sampling is needed, it shall be conducted as specified in section 7.5 of the PEF Guidance v6.3 and implemented in Annex 4 of this PEFCR. However, sampling is not mandatory and any applicant of this PEFCR may decide to collect the data from all the plants or farms, without performing any sampling.

## 5.1. List of mandatory company-specific data

The applicant shall use company-specific activity data for the following processes:

**1. Transportation of materials and ingredients**

For the different transports of materials and ingredients (e.g. grape, oenological practices and packaging materials), the applicant shall provide company-specific data about:

- transport mode,
- distance per transport mode (km),
- utilisation ratios for truck transport (%), and
- empty return modelling for truck transport.

**2. Wine making process and bottling**

The wine making process includes different steps (e.g. fermentation, clarification or stabilisation) entailing the use of permitted oenological practices (additives and processing aids). The process of filling the primary packaging with wine is also included in this stage. Company-specific activity data to provide include:

- the bill of materials (ingredients) used,
- energy consumption (kWh and m3 for fuels),
- water consumption (m3)
- waste generated.

**3. Distribution to retail**

Transportation of packaged or bulk wine from the winery to retail and then from retail to consumer. Company-specific activity data to provide include:

- transport mode,
- distance per transport mode (km),
- utilisation ratios for truck transport (%), and
- empty return modelling for truck transport.

The following table shows an example of the activity data to be collected by the applicant. See excel file named “Wine_PEFCR_v6.3-Life cycle inventory.xlsx” available at http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm for the list of all company-specific data to be collected.

**Table 9. Data collection requirements for mandatory process Packaging of sparkling wine - example**

| Requirements for data collection purposes | | | Requirements for modelling purposes | | | | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Activity data to be collected* | *Specific requirements (e.g. frequency, measurement standard, etc)* | *Unit of measure* | *Default dataset to be used* | *Dataset source (i.e. node)* | *UUID* | *TiR* | *TeR* | *GR* | *P* | *DQR* | |
| Inputs: | | | | | | | | | | | |
| Electricity use | Actual measurement | kWh | Country- specific Electricity grid mix 1kV-60kV | http://lcdn.thinkstep.com/Node/ | {34960d4d-af62-43a0-aa76-adc5fcf57246} | 1.5 | 1 | 1 | 2 | 1.4 | |
| Container glass | Measurement | kg | Container glass, virgin. Virgin container glass (all sizes) to be used for glass bottles and food jars\| Production mix. | http://lcdn.thinkstep.com/Node/ | 5ccf94ab-173c-4688-bcc8-d434166be45e | 2 | 2 | 2 | 2 | 2 | |
| Cork stopper | Measurement | kg | Natural cork stopper, wine | http://lcdn.thinkstep.com/Node/ | {af4888dd-dbc7-4572-84e9-62388d10b0d6} | 1 | 1 | 1 | 2 | 1.3 | |
| Outputs: not applicable | | | | | | | | | | | |

## 5.2. List of processes expected to be run by the company

The following processes are expected to be run by the company applying the PEFCR:

1. **Grape production**

Cultivation of grapes including: vine plant nursery, planting, nourishing and destruction; canopy management; fertilizing management; pest and disease managements; soil management; irrigation (if used) and harvesting.

The following company-specific activity data for this process shall be provided if grape production is under the control of the applicant:

- production yield (kg of grape per ha),
- amount of products applied in the vineyard (plants and soil) (kg and $m^3$ for liquids)
- amount of water used ($m^3$),
- amount and type of energy used (kWh and $m^3$ for fuels),
- amount and type of tying materials used (kg), and
- vineyard surface (ha).

In addition, the applicant will calculate the nitrogen and phosphate emissions derived from the application of fertilizers (see section 6.2) as well as the carbon dioxide emissions from lime, urea and urea-compounds application.

See excel file named "Wine_PEFCR_v6.3-Life cycle inventory.xlsx" available at http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm for the list of all processes to be expected in situation 1.

The applicant is not expected to collect direct elementary flows.

## 5.3. Data gaps

### 5.3.1. Most frequent data gaps on company-specific data to be collected

The following default value shall be used to fill potential data gaps:

- Production of wine must and fresh lees by other companies: 0.0056 kWh of electricity consumed per kg of grape pressed and 0.7 kg of must is produced per kg of grape pressed.
- Filling operations carried out by other companies: 0.0224 kWh of electricity for filling 1 litre of wine into its primary packaging. In case filling operations are carried out by the winery but the energy consumption of this process cannot be isolated from the overall energy consumption of the wine making process, the default value of 0.0224 kWh of electricity for filling 1 litre of wine shall be applied as a proxy. This value will be subtracted from the energy consumption of the wine making process.

### 5.3.2. Data gaps in default datasets listed in this PEFCR

Existing LCI datasets do not cover the complete production cycle of grape in different regions and circumstances (e.g. irrigation, organic production, yield, etc.) and are not EF-compliant. However, when companies applying the PEFCR do not run this process or have no access to company-specific information, default datasets listed in the excel file named "Wine_PEFCR_v6.3-Life cycle inventory.xlsx" available at http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm shall be applied.

### 5.3.3. List of processes excluded from the PEFCR due to missing datasets

The list of secondary datasets to be used when implementing this PEFCR available in the excel file named "Wine_PEFCR_v6.3-Life cycle inventory.xlsx". This file is available at http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm

Whereas some specific inputs are covered by proxies, the following elements remain as data gaps and therefore shall be excluded from the scope of the study:

- Calcium tartrate.
- Concentrate grape must.
- Metatartaric acid.
- Neutral potassium tartrate.
- Ovalbumin.
- Potassium bicarbonate.
- Potassium bisulphite.
- Potassium bitartrate.
- Tartaric acid.
- Fresh lees.

### 5.3.4. The processes for which proxies are to be used

In case ageing in wood barrels is part of the wine making process of the product declared, default datasets for wood and steel production shall be used as proxies taking into account the amount of each material used, unless an EF-compliant dataset is available.

Datasets to be used as proxies are included in the excel file named "Wine_PEFCR_v6.3-Life cycle inventory.xlsx", available at http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm

## 5.4. Data quality requirements

The data quality of each dataset and the total EF study shall be calculated and reported. The calculation of the DQR shall be based on the following formula with 4 criteria:

$$DQR = \frac{\overline{Te_R}+\overline{G_R}+\overline{Ti_R}+\overline{P}}{4} \qquad \text{[Equation 1]}$$

where TeR is the Technological-Representativeness, GR is the Geographical-Representativeness, TiR is the Time-Representativeness, and P is the Precision/uncertainty. The representativeness (technological, geographical and time-related) characterises to what degree the processes and products selected are depicting the system analysed, while the precision indicates the way the data is derived and related level of uncertainty.

The next chapters provide tables with the criteria to be used for the semi-quantitative assessment of each criterion. If a dataset is constructed with company-specific activity data, company -specific emission data and secondary sub-processes, the DQR of each shall be assessed separately.

### 5.4.1 Company-specific datasets

The score of criterion P cannot be higher than 3 while the score for TiR, TeR, and GR cannot be higher than 2 (the DQR score shall be ≤1.6). The DQR shall be calculated at the level-1 disaggregation, before any aggregation of sub-processes or elementary flows is performed. The DQR of company-specific datasets shall be calculated as following:

1) Select the most relevant sub-processes and direct elementary flows that account for at least 80% of the total environmental impact of the company-specific dataset, listing them from the most contributing to the least contributing one.

2) Calculate the DQR criteria TeR, TiR, GR and P for each most relevant process and each most relevant direct elementary flow. The values of each criterion shall be assigned based on Table 10.

> 2.a) Each most relevant elementary flow consists of the amount and elementary flow naming (e.g. 40 g Carbon Dioxide). For each most relevant elementary flow, evaluate the 4 DQR criteria named $Te_{R-EF}$, $Ti_{R-EF}$, $G_{R-EF}$, $P_{EF}$ in Table 10. It shall be evaluated for example, the timing of the flow measured, for which technology the flow was measured and in which geographical area.
>
> 2.b) Each most relevant process is a combination of activity data and the secondary dataset used. For each most relevant process, the DQR is calculated by the applicant of the PEFCR as a combination of the 4 DQR criteria for activity data and the secondary dataset: (i) $Ti_R$ and P shall be evaluated at the level of the activity data (named $Ti_{R-AD}$, $P_{AD}$) and (ii) $Te_R$, $Ti_R$ and $G_R$ shall be evaluated at the level of the secondary dataset used (named $Te_{R-SD}$ , $Ti_{R-SD}$ and $G_{R-SD}$). As $Ti_R$ is evaluated twice, the mathematical average of $Ti_{R-AD}$ and $Ti_{R-SD}$ represents the $Ti_R$ of the most relevant process.
>
> 2.c) Considering that the data for the mandatory processes shall be company specific, the score of P cannot be higher than 3 while the score for TiR, TeR, and GR cannot be higher than 2 (The DQR score shall be ≤1.6).

3) Calculate the environmental contribution of each most-relevant process and elementary flow to the total environmental impact of all most-relevant processes and elementary flows, in % (weighted using 13 EF impact categories, with the exclusion of the 3 toxicity-related ones).

For example, the newly developed dataset has only two most relevant processes, contributing in total to 80% of the total environmental impact of the dataset:

- Process 1 carries 30% of the total dataset environmental impact. The contribution of this process to the total of 80% is 37.5% (the latter is the weight to be used).
- Process 1 carries 50% of the total dataset environmental impact. The contribution of this process to the total of 80% is 62.5% (the latter is the weight to be used).

4) Calculate the $Te_R$, $Ti_R$, $G_R$ and P criteria of the newly developed dataset as the weighted average of each criterion of the most relevant processes and direct elementary flows. The weight is the relative contribution (in %) of each most relevant process and direct elementary flow calculated in step 3.

5) The applicant of the PEFCR shall calculate the total DQR of the newly developed dataset using the equation 2, where $\overline{Te_R}, \overline{G_R}, \overline{Ti_R}, \overline{P}$ are the weighted average calculated as specified in point 4).

$$DQR = \frac{\overline{Te_R} + \overline{G_R} + \overline{Ti_R} + \overline{P}}{4}$$

[Equation 2]

NOTE: in case the newly developed dataset has most relevant processes filled in by non-EF compliant datasets (and thus without DQR), then these datasets cannot be included in step 4 and 5 of the DQR calculation. (1) The weight of step 3 shall be recalculated for the EF-compliant datasets only. Calculate the environmental contribution of each most-relevant EF compliant process and elementary flow to the total environmental impact of all most-relevant EF compliant processes and elementary flows, in %. Continue with step 4 and 5. (2) The weight of the non-EF compliant dataset (calculated in step 3) shall be used to increase the DQR criteria and total DQR accordingly. For example:

- Process 1 carries 30% of the total dataset environmental impact and is ILCD entry level compliant. The contribution of this process to the total of 80% is 37.5% (the latter is the weight to be used).
- Process 1 carries 50% of the total dataset environmental impact and is EF compliant. The contribution of this process to all most-relevant EF compliant processes is 100%. The latter is the weight to be used in step 4.
- After step 5, the parameters $\overline{Te_R}, \overline{G_R}, \overline{Ti_R}, \overline{P}$ and the total DQR shall be multiplied with 1.375.

**Table 10. How to assess the value of the DQR criteria for datasets with company-specific information**

| | $P_{EF}$ and $P_{AD}$ | $Ti_{R-EF}$ and $Ti_{R-AD}$ | $Ti_{R-SD}$ | $Te_{R-EF}$ and $Te_{R-SD}$ | $G_{R-EF}$ and $G_{R-SD}$ |
|---|---|---|---|---|---|
| **1** | Measured/calculated and externally verified | The data refers to the most recent annual administration period with respect to the EF report publication date | The EF report publication date happens within the time validity of the dataset | The elementary flows and the secondary dataset reflect exactly the technology of the newly developed dataset | The data(set) reflects the exact geography where the process modelled in the newly created dataset takes place |
| **2** | Measured/calculated and internally verified, plausibility checked by reviewer | The data refers to maximum 2 annual administration periods with respect to the EF report publication date | The EF report publication date happens not later than 2 years beyond the time validity of the dataset | The elementary flows and the secondary dataset is a proxy of the technology of the newly developed dataset | The data(set) partly reflects the geography where the process modelled in the newly created dataset takes place |
| **3** | Measured/calculated/literature and plausibility not checked by reviewer OR Qualified estimate based on calculations plausibility checked by reviewer | The data refers to maximum three annual administration periods with respect to the EF report publication date | Not applicable | Not applicable | Not applicable |
| **4-5** | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable |

## 5.5. Data needs matrix (DNM)

All processes required modelling the product and outside the list of mandatory company-specific (listed in section 5.1) shall be evaluated using the Data Needs Matrix (see Table 11). The DNM shall be used by the PEFCR applicant to evaluate which data is needed and shall be used within the modelling of its PEF, depending on the level of influence the applicant (company) has on the specific process. The following three cases are found in the DNM and are explained below:

1. **Situation 1**: the process is run by the company applying the PEFCR.
2. **Situation 2**: the process is not run by the company applying the PEFCR but the company has access to (company-)specific information.
3. **Situation 3**: the process is not run by the company applying the PEFCR and this company does not have access to (company-)specific information.

**Table 11. Table Data Needs Matrix (DNM)[11]. *Disaggregated datasets shall be used.**

<table>
<tr><th></th><th></th><th>Most relevant process</th><th>Other process</th></tr>
<tr><td rowspan="2">Situation 1: process run by the company applying the PEFCR</td><td>Option 1</td><td colspan="2">Provide company-specific data (as requested in the PEFCR) and create a company specific dataset partially disaggregated at least at level 1 (DQR ≤1.6).<br><br>Calculate the DQR values (for each criteria + total)</td></tr>
<tr><td>Option 2</td><td></td><td>Use default secondary dataset in PEFCR, in aggregated form (DQR ≤3.0).<br><br>Use the default DQR values</td></tr>
<tr><td rowspan="3">Situation 2: process <u>not</u> run by the company applying the PEFCR but with access to (company-)specific information</td><td>Option 1</td><td colspan="2">Provide company-specific data (as requested in the PEFCR) and create a company specific dataset partially disaggregated at least at level 1 (DQR ≤1.6).<br><br>Calculate the DQR values (for each criteria + total)</td></tr>
<tr><td>Option 2</td><td>Use company-specific activity data for transport (distance), and substitute the sub-processes used for electricity mix and transport with supply-chain specific PEF compliant datasets (DQR ≤3.0).*<br><br>Re-evaluate the DQR criteria within the product specific context</td><td></td></tr>
<tr><td>Option 3</td><td></td><td>Use company-specific activity data for transport (distance), and substitute the sub-processes used for electricity mix and transport with supply-chain specific PEF compliant datasets (DQR ≤4.0).<br><br>Use the default DQR values</td></tr>
<tr><td rowspan="2">Situation 3: process <u>not</u> run by the company applying the PEFCR and <u>without</u> access to (company)-specific information</td><td>Option 1</td><td>Use default secondary dataset, in aggregated form (DQR ≤3.0).<br><br>Re-evaluate the DQR criteria within the product specific context</td><td></td></tr>
<tr><td>Option 2</td><td></td><td>Use default secondary dataset in PEFCR, in aggregated form (DQR ≤4.0)<br><br>Use the default DQR values</td></tr>
</table>

## 5.5.1 Processes in situation 1

For each process in situation 1 there are two possible options:

[11] The options described in the DNM are not listed in order of preference

- The process is in the list of most relevant processes as specified in the PEFCR or is not in the list of most relevant process, but still the company wants to provide company specific data (option 1);
- The process is not in the list of most relevant processes and the company prefers to use a secondary dataset (option 2).

**Situation 1/Option 1**

For all processes run by the company and where the company applying the PEFCR uses company specific data. The DQR of the newly developed dataset shall be evaluated as described in section 5.4.1.

**Situation 1/Option 2**

For the non-most relevant processes only, if the applicant decides to model the process without collecting company-specific data, then the applicant shall use the secondary dataset listed in the PEFCR together with its default DQR values listed here.

If the default dataset to be used for the process is not listed in the PEFCR, the applicant of the PEFCR shall take the DQR values from the metadata of the original dataset.

### 5.5.2 Processes in situation 2

When a process is not run by the company applying the PEFCR, but there is access to company-specific data, then there are two possible options:

- The company applying the PEFCR has access to extensive supplier-specific information and wants to create a new EF-compliant dataset[12] (option 1);
- The company has some supplier-specific information and want to make some minimum changes (option 2).
- The process is not in the list of most relevant processes and the company prefers to use a secondary dataset (option 3).

**Situation 2/Option 1**

For all processes run by the company and where the company applying the PEFCR uses company specific data. The DQR of the newly developed dataset shall be evaluated as described in section 5.4.1.

**Situation 2/Option 2**

Company-specific activity data for transport are used and the sub-processes used for electricity mix and transport with supply-chain specific PEF compliant datasets are substituted starting from the default secondary dataset provided in the PEFCR.

Please note that, the PEFCR lists all dataset names together with the UUID of their aggregated dataset. For this situation, the disaggregated version of the dataset is required.

[12] The review of the newly created dataset is optional

The applicant of the PEFCR shall make the DQR values of the dataset used context-specific by re-evaluating $Te_R$ and $Ti_R$, using the table(s) provided in this PEFCR. The criteria $G_R$ shall be lowered by 30%[13] and the criteria P shall keep the original value.

**<u>Situation 2/Option 3</u>**

For the non-most relevant processes, the applicant may use the corresponding secondary dataset listed in the PEFCR together with its DQR values.

If the default dataset to be used for the process is not listed in the PEFCR, the applicant of the PEFCR shall take the DQR values from the original dataset.

**Table 12. How to assess the value of the DQR criteria when secondary datasets are used.**

| | TiR | TeR | $G_R$ |
|---|---|---|---|
| **1** | The EF report publication date happens within the time validity of the dataset | The technology used in the EF study is exactly the same as the one in scope of the dataset | The process modelled in the EF study takes place in the country the dataset is valid for |
| **2** | The EF report publication date happens not later than 2 years beyond the time validity of the dataset | The technologies used in the EF study is included in the mix of technologies in scope of the dataset | The process modelled in the EF study takes place in the geographical region (e.g. Europe) the dataset is valid for |
| **3** | The EF report publication date happens not later than 4 years beyond the time validity of the dataset | The technologies used in the EF study are only partly included in the scope of the dataset | The process modelled in the EF study takes place in one of the geographical regions the dataset is valid for |
| **4** | The EF report publication date happens not later than 6 years beyond the time validity of the dataset | The technologies used in the EF study are similar to those included in the scope of the dataset | The process modelled in the EF study takes place in a country that is not included in the geographical region(s) the dataset is valid for, but sufficient similarities are estimated based on expert judgement. |
| **5** | The EF report publication date happens later than 6 after the time validity of the dataset | The technologies used in the EF study are different from those included in the scope of the dataset | The process modelled in the EF study takes place in a different country than the one the dataset is valid for |

### 5.5.3 Processes in situation 3

When a process is not run by the company applying the PEFCR and the company does not have access to company-specific data, there are two possible options:

- It is in the list of most relevant processes (situation 3, option 1)
- It is not in the list of most relevant processes (situation 3, option 2)

[13] In situation 2, option 2 it is proposed to lower the parameter $G_R$ by 30% in order to incentivize the use of company specific information and reward the efforts of the company in increasing the geographic representativeness of a secondary dataset through the substitution of the electricity mixes and of the distance and means of transportation.

**Situation 3/Option 1**

In this case, the applicant of the PEFCR shall make the DQR values of the dataset used context-specific by re-evaluating $Te_R$, $Ti_R$ and $G_r$ , using the table(s) provided. The criteria P shall keep the original value.

**Situation 3/Option 2**

For the non-most relevant processes, the applicant shall use the corresponding secondary dataset listed in the PEFCR together with its DQR values.

If the default dataset to be used for the process is not listed in the PEFCR, the applicant of the PEFCR shall take the DQR values from the original dataset.

## 5.6. Which datasets to use?

The secondary datasets to be used by the applicant are those listed in this PEFCR. Whenever a dataset needed to calculate the PEF-profile is not among those listed in this PEFCR, then the applicant shall choose between the following options (in hierarchical order):

- Use an EF-compliant dataset available on one of the following nodes:
    - http://eplca.jrc.ec.europa.eu/EF-node
    - http://lcdn.blonkconsultants.nl
    - http://ecoinvent.lca-data.com
    - http://lcdn-cepe.org
    - https://lcdn.quantis-software.com/PEF/
    - http://lcdn.thinkstep.com/Node
- Use an EF-compliant dataset available in a free or commercial source;
- Use another EF-compliant dataset considered to be a good proxy. In such case this information shall be included in the "limitation" section of the PEF report.
- Use an ILCD-entry level-compliant dataset that has been modelled according to the modelling requirements included in the Guidance version 6.3. In such case this information shall be included in the "limitations" section of the PEF report.
- Use an ILCD-entry level-compliant dataset. In such case this information shall be included in the "data gap" section of the PEF report.

## 5.7. How to calculate the average DQR of the study

In order to calculate the average DQR of the EF study, the applicant shall calculate separately the TeR, TiR, GR and P for the EF study as the weighted average of all most relevant processes, based on their relative environmental contribution to the total single score (excluding the 3 toxicity-related ones). The calculation rules explained in chapter 5.4 shall be used and the DQR of the EF study shall be reported in the EF report.

## 5.8. Allocation rules

Allocation shall be conducted as described in the following table.

**Table 13. Allocation rules**

| Process | Allocation rule | Modelling instructions |
|---|---|---|
| Grape production – allocation of co-products (grape must and grape pomace) | Physical allocation | The mass of the different outputs shall be used to allocate grape production and transportation. |
| Wine making – allocation of co-products (wine and lees) | Physical allocation | The mass of the different outputs shall be used to allocate grape production and transportation and wine making process until the separation of lees. |

Activity data shall regarding the weight of the different co-products shall be used to apply these allocation rules. Typical values are: 80% for wine, 19% for grape pomace and 1% of lees.

## 5.9. Electricity modelling

The guidelines in this section shall only be used for the processes where company-specific information is collected (situation 1 / Option 1 & 2 / Option 1 of the DNM).

The following electricity mix shall be used in hierarchical order:

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

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

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

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

Note: for the use stage the consumption grid mix shall be used.

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

<u>Set of minimal criteria to ensure contractual instruments from suppliers:</u>

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

A contractual instrument used for electricity modelling shall:

1. Convey attributes:
    - Convey the energy type mix associated with the unit of electricity produced.
    - The energy type mix shall be calculated based on delivered electricity, incorporating certificates sourced and retired on behalf of its customers. Electricity from facilities for which the attributes have been sold off (via contracts or certificates) shall be characterized as having the environmental attributes of the country residual consumption mix where the facility is located.
2. Be a unique claim:
    - Be the only instruments that carry the environmental attribute claim associated with that quantity of electricity generated.
    - Be tracked and redeemed, retired, or cancelled by or on behalf of the company (e.g. by an audit of contracts, third-party certification, or may be handled automatically through other disclosure registries, systems, or mechanisms).
3. Be as close as possible to the period to which the contractual instrument is applied.

<u>Modelling 'country-specific residual grid mix, consumption mix':</u>

Datasets for residual grid mix, per energy type, per country and per voltage have been purchased by the European Commission and are available in the dedicated node (http://lcdn.thinkstep.com/Node/). In case the necessary dataset is not available, an alternative dataset shall be chosen according to the procedure described in section 5.6. If no dataset is available, the following approach may be used:

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

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

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

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

<u>Allocation rules:</u>

Table 14 gives instructions on how to assign the electricity consumption of the wine making process among multiple products.

**Table 14. Allocation rules for electricity.**

| **Process** | **Physical relationship** | **Modelling instructions** |
|---|---|---|
| Wine making | Mass | If specific energy metering is available for the different product stages, separate the energy consumption associated to the specific processes related to the product assessed taking into account the duration of the processes and the amount of wine processed.<br>E.g. for wine ageing: average monthly electricity consumption of the ageing room per amount of wine processed and multiplied for the number of months the wine is aged<br>Electricity consumption of common spaces and processes (offices, lighting, etc.) shall be allocated to the product applying the factor resulting from dividing the annual electricity consumption by the total amount of wine produced.<br>If specific metering is not available, the latter instruction shall be applied for all the total amount of electricity consumed. |

If the consumed electricity comes from more than one electricity mix, each mix source shall be used in terms of its proportion in the total kWh consumed. For example, if a fraction of this total kWh consumed is coming from a specific supplier a supplier-specific electricity mix shall be used for this part. See below for on-site electricity use.

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

a. The production (and related electricity consumption) of a product occurs in a separate site (building), the energy type physical related to this separated site may be used.
b. The production (and related electricity consumption) of a product occurs in a shared space with specific energy metering or purchase records or electricity bills, the product specific information (measure, record, bill) may be used.
c. All the products produced in the specific plant are supplied with a public available PEF study. The company who wants to make the claim shall make all PEF studies available. The allocation rule applied shall be described in the PEF study, consistently applied in all PEF studies connected to the site and verified. An example is the 100% allocation of a greener electricity mix to a specific product.

<u>On-site electricity generation:</u>

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

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

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

- If possible, apply subdivision.
- Subdivision applies both to separate electricity productions or to a common electricity production where you can allocate based on electricity amounts the upstream and direct emissions to your own consumption and to the share you sell out of your company (e.g. if a company has a wind mill on its production site and export 30% of the produced electricity, emissions related to 70% of produced electricity should be accounted in the PEF study).
- If not possible, direct substitution shall be used. The country-specific residual consumption electricity mix shall be used as substitution[14].
- Subdivision is considered as not possible when upstream impacts or direct emissions are closely related to the product itself.

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

## 5.10. Climate change modelling

The impact category 'climate change' shall be modelled considering three sub-categories:

1. **Climate change – fossil**: This sub-category includes emissions from peat and calcination/carbonation of limestone. The emission flows ending with '(fossil)' (e.g., 'carbon dioxide (fossil)'' and 'methane (fossil)') shall be used if available.

2. **Climate change – biogenic**: This sub-category covers carbon emissions to air ($CO_2$, CO and $CH_4$) originating from the oxidation and/or reduction of biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and $CO_2$ uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or aboveground plant residues such as litter and dead wood. Carbon exchanges from native forests[15] shall be modelled under sub-category 3 (incl. connected soil emissions, derived products, residues). The emission flows ending with '(biogenic)' shall be used.

   A simplified modelling approach shall be used when modelling the foreground emissions: **Yes**. Only the emission 'methane (biogenic)' is modelled, while no further biogenic emissions and uptakes from atmosphere are included. When methane emissions can be both fossil and biogenic, the release of biogenic methane shall be modelled first and then the remaining fossil methane."

   Does the product life cycle or part of the life cycle has a carbon storage beyond 100 years and therefore credits from biogenic carbon storage shall be modelled: **Yes**. Carbon credits shall be modelled by including an emission uptake as 'resource from air' using the elementary flow 'carbon dioxide (biogenic-100yr)'. Carbon credits shall be properly allocated among the different byproducts the system delivered over the full timeframe. Chapter 14.1 specifies the calculation method to be used in order to get the credits.

3. **Climate change – land use and land transformation**: This sub-category accounts for carbon uptakes and emissions ($CO_2$, CO and $CH_4$) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (incl. soil carbon emissions). For native forests, all related $CO_2$ emissions are included and modelled under this sub-category (including connected soil emissions, products derived from native forest[16] and residues), while their $CO_2$ uptake is excluded. The emission flows ending with '(land use change)' shall be used.

[15] Native forests – represents native or long-term, non-degraded forests. Definition adapted from table 8 in Annex V C(2010)3751 to Directive 2009/28/EC.

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

For land use change, all carbon emissions and removals shall be modelled following the modelling guidelines of PAS 2050:2011 (BSI 2011) and the supplementary document PAS2050-1:2012 (BSI 2012) for horticultural products. PAS 2050:2011 (BSI 2011): Large emissions of GHGs can result as a consequence of land use change. Removals as a direct result of land use change (and not as a result of long-term management practices) do not usually occur, although it is recognized that this could happen in specific circumstances. Examples of direct land use change are the conversion of land used for growing crops to industrial use or conversion from forestland to cropland. All forms of land use change that result in emissions or removals are to be included. Indirect land use change refers to such conversions of land use as a consequence of changes in land use elsewhere. While GHG emissions also arise from indirect land use change, the methods and data requirements for calculating these emissions are not fully developed. Therefore, the assessment of emissions arising from indirect land use change is not included.
The GHG emissions and removals arising from direct land use change shall be assessed for any input to the life cycle of a product originating from that land and shall be included in the assessment of GHG emissions. The emissions arising from the product shall be assessed on the basis of the default land use change values provided in PAS 2050:2011 Annex C, unless better data is available. For countries and land use changes not included in this annex, the emissions arising from the product shall be assessed using the included GHG emissions and removals occurring as a result of direct land use change in accordance with the relevant sections of the IPCC (2006). The assessment of the impact of land use change shall include all direct land use change occurring not more than 20 years, or a single harvest period, prior to undertaking the assessment (whichever is the longer). The total GHG emissions and removals arising from direct land use change over the period shall be included in the quantification of GHG emissions of products arising from this land on the basis of equal allocation to each year of the period.

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

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

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

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

1. where the country of production is known and the previous land use is known, the GHG emissions and removals arising from land use change shall be those resulting from the change in land use from the previous land use to the current land use in that country (additional guidelines on the calculations can be found in PAS 2050-1:2012);
2. where the country of production is known, but the former land use is not known, the GHG emissions arising from land use change shall be the estimate of average emissions from the land use change for that crop in that country (additional guidelines on the calculations can be found in PAS 2050-1:2012);
3. where neither the country of production nor the former land use is known, the GHG emissions arising from land use change shall be the weighted average of the average land use change emissions of that commodity in the countries in which it is grown.

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

Soil carbon storage shall be modelled, calculated and reported as additional environmental information: Yes. Modelling rules and proof to be provided are explained in Annex 5 of this PEFCR.

The sum of the three sub-categories shall be reported.

The sub-category 'Climate change-biogenic' shall be reported separately: **Yes**

The sub-category 'Climate change-land use and land transformation' shall be reported separately: **Yes**

## 5.11. Modelling of wastes and recycled content

The waste of products used during the manufacturing, distribution, retail, the use stage or after use shall be included in the overall modelling of the life cycle of the organisation. Overall, this should be modelled and reported at the life cycle stage where the waste occurs. This section gives guidelines on how to model the End-of-Life of products as well as the recycled content.

The Circular Footprint Formula is used to model the End-of-Life of products as well as the recycled content and is a combination of "material + energy + disposal", i.e.:

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

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

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

With the following parameters:

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

**B:** allocation factor of energy recovery processes: it applies both to burdens and credits. It shall be set to zero for all PEF studies.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The specific values of parameters A, Q, R1 and R2 are provided in Chapter 6.1.1.

# 6 Life cycle stages

## 6.1. Raw material acquisition and pre-processing

The processes taking place in this life cycle stage are:

- Grape production
- Grape transportation from supplier to winery
- Primary packaging production
- Secondary packaging production
- Tertiary packaging production
- Primary packaging transportation from supplier to winery
- Secondary packaging transportation from supplier to winery
- Tertiary packaging transportation from supplier to winery
- Oenological practices production
- Oenological practices transportation

See excel file named "Wine_PEFCR_v6.3-Life cycle inventory.xlsx" (available at http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm) for the list of all processes to be included in this stage and the following table for an example of the information to be provided.

**Table 15.** ***Raw material acquisition and processing (capitals indicate those processes expected to be run by the company) – example for primary packaging of sparkling wine***

| ***Process name*** | ***Unit of measurement (output)*** | ***Default*** | | | | ***UUID*** | ***Default DQR*** | | | | ***Most relevant process [Y/N]*** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ***$R_1$*** | ***Amount per FU*** | ***Dataset*** | ***Dataset source*** | | *P* | *TiR* | *GR* | *TeR* | |
| *Glass container* | *kg* | *0,52* | *Company specific* | Container glass, virgin. Virgin container glass (all sizes) to be used for glass bottles and food jars\| Production mix. | http://lcdn.thinkstep.com/Node/ | 5ccf94ab-173c-4688-bcc8-d434166be45e | 2 | 2 | 2 | 2 | *Y* |
| *Cork stopper - champagne* | *kg* | *0* | *Company specific* | Natural cork stopper, wine | http://lcdn.thinkstep.com/Node/ | 4b4f01f5-05bd-433b-96c5-73242a04127d | 2 | 3 | 3 | 2 | *N* |

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

Regarding packaging:

- In case beverage cartons and/or bag-in-box are used, the applicant shall use the default aggregated datasets for these packaging options.
- In case reusable packaging is used, the reuse rate affects the quantity of transport that is needed per FU. The transport impact shall be calculated by dividing the one-way trip impact by the number of times this packaging is reused.
- For company owned packaging pools the reuse rate shall be calculated using supply-chain-specific data as explained in Annex 7.
- The following reuse rates shall be used if third party operated reusable packaging pools are in scope:
  - Glass bottles: 5 trips for wine[17]
  - Plastic pallets: 50 trips[18]
  - Wooden pallets: 25 trips[19]

### 6.1.1. Modelling the recycled content (if applicable)

The following formula is used to model the recycled content:

$$(1 - R_1)E_V + R_1 \times \left(AE_{recycled} + (1 - A)E_V \times \frac{Q_{Sin}}{Q_p}\right)$$

The $R_1$ values applied shall be supply-chain or default as provided in the table above, in relation with the DNM. Material-specific values based on supply market statistics are not accepted as a proxy. The applied $R_1$ values shall be subject to PEF study verification.

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

- The supplier information (through e.g., statement of conformity or delivery note) shall be maintained during all stages of production and delivery at the converter;
- Once the material is delivered to the converter for production of the end products, the converter shall handle information through their regular administrative procedures;

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

18 Nederlands Instituut voor Bouwbiologie en Ecologie, 2014. The less conservative number is used.

19 Nederlands Instituut voor Bouwbiologie en Ecologie, 2014. Half of plastic pallets is used as approximation.

- The converter for production of the end products claiming recycled content shall demonstrate through his management system the [%] of recycled input material into the respective end product(s).
- The latter demonstration shall be transferred upon request to the user of the end product. In case a PEF profile is calculated and reported, this shall be stated as additional technical information of the PEF profile.
- Company-owned traceability systems can be applied as long as they cover the general guidelines outlined above.

Table 16 provides default parameters for modelling the recycled content of packaging materials applying the Circular Footprint Formula.

**Table 16. Default parameters for modelling the recycled content of packaging materials applying the Circular Footprint Formula**

| Packaging material | A | R1 | R2 | R3 | Qsin | Qp |
|---|---|---|---|---|---|---|
| Aluminium – packaging - can | 0,20 | 0,00 | 0,69 | 0,07 | 1,00 | 1,00 |
| Aluminium - packaging - liquid beverage carton | 0,20 | 0,00 | 0,43 | 0,26 | 1,00 | 1,00 |
| Cardboard | 0,20 | 0,47 | 0,75 | 0,11 | 0,85 | 1,00 |
| Cardboard - packaging - liquid beverage carton | 0,20 | 0,00 | 0,43 | 0,26 | 0,85 | 1,00 |
| Cork | 0,80[20] | 0,00 | 0,00 | 0,45 | 1,00 | 1,00 |
| Glass | 0,20 | 0,52 | 0,66 | 0,15 | 1,00 | 1,00 |
| LDPE | 0,50 | 0,00 | 0,00 | 0,45 | 0,75 | 1,00 |
| LDPE - packaging - liquid beverage carton | 0,50 | 0,00 | 0,43 | 0,26 | 0,75 | 1,00 |
| PET | 0,50 | 0,00 | 0,42 | 0,26 | 1,00 | 1,00 |
| Wood | 0,80 | 0,00 | 0,30 | 0,45 | 1,00 | 1,00 |

### 6.1.2. Transportation of inputs from suppliers to producer

For the different transports of materials and ingredients (i.e. grape, oenological practices and materials), the applicant shall use the following default scenarios in case no specific-data on (i) transport mode, (ii) distance per transport mode, (iii) utilisation ratios for truck transport and (iv) empty return modelling for truck transport, is available.

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

For grape, the following scenario shall be used:

- 25 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), 64% utilisation ratio;

For packaging materials from manufacturing plants to filler plants (beside glass; values based on Eurostat 2015[21]), the following scenario shall be used:

[20] Note that this A value deviates from the number to be used following the PEFCR Guidance version 6.3. In case the A-value is not provided in Annex C, a value of 0.5 is to be used. The applied A-value will be corrected in the next update of the PEFCR or added to Annex C.

- 230 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), 64% utilisation ratio; and
- 280 km by train (average freight train; UUID 02e87631-6d70-48ce-affd-1975dc36f5be); and
- 360 km by ship (barge; UUID 4cfacea0-cce4-4b4d-bd2b-223c8d4c90ae).

For transport of empty glass bottles (communication from FEVE[22]), the following scenario shall be used:

- 350 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), 64% utilisation ratio; and
- 39 km by train (average freight train; UUID 02e87631-6d70-48ce-affd-1975dc36f5be); and
- 87 km by ship (barge; UUID 4cfacea0-cce4-4b4d-bd2b-223c8d4c90ae).

For all other products from supplier to factory (values based on Eurostat 2015[23]), the following scenario shall be used:

- 130 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), 64% utilisation ratio; and
- 240 km by train (average freight train; UUID 02e87631-6d70-48ce-affd-1975dc36f5be); and
- 270 km by ship (barge; UUID 4cfacea0-cce4-4b4d-bd2b-223c8d4c90ae).

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

- 1000 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), for the sum of distances from harbour/airport to factory outside and inside Europem 64% utilisation ratio; and
- 18000 km by ship (transoceanic container; UUID 6ca61112-1d5b-473c-abfa-4accc66a8a63) or 10'000 km by plane (cargo; UUID 1cc5d465-a12a-43da-aa86-a9c6383c78ac).
- If producers country (origin) is known: the adequate distance for ship and airplane should be determined using http://www.searates.com/services/routes-explorer or https://co2.myclimate.org/en/flight_calculators/new.

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

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

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

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

## 6.2. Agricultural modelling (grape production)

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

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

Cultivation data shall be collected over a period of time sufficient to provide an average assessment of the life cycle inventory associated with the inputs and outputs of cultivation that will offset fluctuations due to seasonal differences. Being grape an annual crop, an assessment period of at least three years shall be used (to level out differences in crop yields related to fluctuations in growing conditions over the years such as climate, pests and diseases, et cetera). Where data covering a three-year period is not available i.e. due to starting up a new production system (e.g. new greenhouse, newly cleared land, shift to other crop), the assessment may be conducted over a shorter period, but shall be not less than 1 year.

Pesticide emissions shall be modelled as specific active ingredients. As default approach, the pesticides applied on the field shall be modelled as 90% emitted to the agricultural soil compartment, 9% emitted to air and 1% emitted to water.

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

- $NH_3$ to air (from N-fertiliser application)
- $N_2O$ to air (direct and indirect) (from N-fertiliser application)
- $CO_2$ to air (from lime, urea and urea-compounds application) (1.57 kg $CO_2$ / kg urea)
- $NO_3$ to water unspecified (leaching from N-fertiliser application)
- $PO_4$ to water unspecified or freshwater (leaching and run-off of soluble phosphate from P-fertiliser application) (3.07 kg $PO_4$ / kg P)
- P to water unspecified or freshwater (soil particles containing phosphorous, from P-fertiliser application).

The LCI for P emissions should be modelled as the amount of P emitted to water after run-off and the emission compartment 'water' shall be used. When this amount is not available, the LCI may be modelled as the amount of P applied on the agricultural field (through manure or fertilisers) and the emission compartment 'soil' shall be used. In this case, the run-off from soil to water is part of the impact assessment method.

The LCI for N emissions shall be modelled as the amount of emissions after it leaves the field (soil) and ending up in the different air and water compartments per amount of fertilisers applied. N emissions to soil shall not be modelled. The nitrogen emissions shall be calculated from Nitrogen applications of the farmer on the field and excluding external sources (e.g. rain deposition). Parameters included in the following table shall be applied.

**Table 17. Parameters to be used when modelling nitrogen emission in soil.**

| Emission | Compartment | Value to be applied |
|---|---|---|
| $N_2O$ (synthetic fertiliser and manure; direct and indirect) | Air | 0.022 kg $N_2O$/ kg N fertilizer applied |
| $NH_3$ (synthetic fertiliser) | Air | kg $NH_3$= kg N * FracGASF= 1*0.1* (17/14)= 0.12 kg $NH_3$/ kg N fertilizer applied |
| $NH_3$ (manure) | Air | kg $NH_3$= kg N*FracGASF= 1*0.2* (17/14)= 0.24 kg $NH_3$/ kg N manure applied |
| $NO_3^-$ (synthetic fertiliser and manure) | Water | kg $NO_3^-$= kg N*FracLEACH = 1*0.3*(62/14) = 1.33 kg $NO_3^-$/ kg N applied |
| P based fertilisers | Water | 0.05 kg P/ kg P applied |

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

The final fate of the heavy metals elementary flows are not further considered within the system boundary: the inventory does not account for the final emissions of the heavy metals and therefore shall not account for the uptake of heavy metals by the crop. For example, heavy metals in agricultural crops cultivated for human consumption end up in the plant. Within the EF context human consumption is not modelled, the final fate is not further modelled and the plant acts as a heavy metal sink. Therefore, the uptake of heavy metals by the crop shall not be modelled.

The following activities shall be included:

- Machine use (hours, type) (to be included if there is high level of mechanisation)
- Input N from crop residues that stay on the field or are burned (kg residue + N content/ha)
- Crop yield (kg/ha)
- Field operations through total energy consumption (amount and type per ha), total water consumption (kg/ha) and total consumption of tying materials, irrigation equipment, etc. (amount and type per ha)

## 6.3. Manufacturing (wine making)

Grapes transported to the winery are weighed, classified and usually crushed to liberate the juice without squashing the seeds. At this point, two co-products are obtained: grape must (used to make the wine) and grape pomace that proceeds to the distillation industry to produce spirits, industrial alcohol, etc. Grape must may be transported to other wineries or used within the same production site where grapes have been crushed.

Then, the vinification process starts and it will differ depending mainly on the type of wine: still or sparkling; white, red or rosé: and conventional or organic. Wine making includes different steps such as fermentation, clarification or stabilisation, entailing the use of permitted oenological practices (additives and processing aids) regulated by the EU wine legislation in the form of a positive list. In addition to wine, the wine making process produces lees which are also derivate to the distillation industry.

In any case, the following processes shall be included:

- Vinification.
- Ageing (if applied): production, transportation and waste management of barrels. If barrels are used in several production cycles, only part of these processes will be allocated to the product assessed taking into account the ratio between ageing time and the total service life of the barrel.
- Packing of wine (filling operations).
- Cleaning operations.
- Management of the waste produced.

The specific bill of materials (i.e. quantity and type of grape used, oenological practices and primary packaging) of the product assessed shall be used. Specific data on energy, water or waste flows referred to the assessed product shall be used whenever available (if, for instance, energy or water meters are installed); if not available, aggregated annual data for the whole product line or even the whole winery can be used for calculating the energy, water or waste flows. In any case, annual data shall be divided by the total volume of wine produced in the same period.

The waste of products used during the manufacturing shall be included in the modelling. Specific product losses shall be taken into account.

See excel file named “Wine_PEFCR_v6.3-Life cycle inventory.xlsx” (available at http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm) for the list of all processes to be included in this stage and the following table for an example of the information to be provided.

**Table 18. Manufacturing (capitals indicate those processes expected to be run by the company) – example for grape pressing process**

| Name of the process | Unit of measurement (output) | Default amount per FU | Default dataset to be used | Dataset source | UUID | Default DQR | | | | Most relevant process [Y/N] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | P | $Ti_R$ | $G_R$ | $Te_R$ | |
| Organic | kg | Company | Grape, full | Agribalyse | N.a. | - | - | - | - | Y |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| grape | | specific | production (phase), organic, variety mix, Languedoc-Roussillon | – v.1.2 | | | | | | |
| Conventional grape | kg | Company specific | Grape, full production (phase), integrated, variety mix, Languedoc-Roussillon | Agribalyse – v.1.2 | N.a. | - | - | - | - | Y |
| Transportation of grapes | Weight, kg | Company specific | Articulated lorry transport, Total weight >32 t, mix Euro 0-5 | http://lcdn.thinkstep.com/Node/ | 328984f2-4a54-419a-b88a-5426a75d0b27 | 1 | 1 | 3 | 2 | N |
| | Distance, km | 25 | | | | | | | | |
| | Utilisation rate, % | 64 | | | | | | | | |
| GRAPE PRESSING – electricity | kWh/kg of grape | 0,0056 | Country-specific electricity grid mix 1kV-60kV AC, technology mix consumption mix, at consumer 1kV - 60kV | http://lcdn.thinkstep.com/Node/ | 34960d4d-af62-43a0-aa76-adc5fcf57246 | 2 | 1 | 1 | 1 | N |

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

## 6.4. Distribution stage

The transport from factory to final client (including consumer transport) shall be modelled within this life cycle stage. The final client is defined as the wine consumer.

A default transport scenario is provided in this PEFCR. In case supply-chain-specific information is available for one or several transport parameters, they may be applied following the Data Needs Matrix.

(1) From factory to retail:

- 75% still wine and 97% sparkling wine to local supply chain: 1'200 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), 64% utilisation ratio.
- 25% still wine and 3% sparkling wine to international supply chain: 1'000 km by truck (>32 t, EURO 4; UUID 938d5ba6-17e4-4f0d-bef0-481608681f57), 64% utilisation ration

and 18'000 km by ship (transoceanic container; UUID 6ca61112-1d5b-473c-abfa-4accc66a8a63).

(2) From retail to final client:

- 62%: 5 km, by passenger car (average; UUID 1ead35dd-fc71-4b0c-9410-7e39da95c7dc), applying a allocation factor of 0.02772 (based on volume transported),
- 5%: 5 km round trip, by van (lorry <7.5t, EURO 3 with utilisation ratio of 20%[6]; UUID aea613ae-573b-443a-aba2-6a69900ca2ff)
- 33%: no impact modelled.

The following table lists all processes taking place in the scenario.

**Table 19. Distribution (capitals indicate those processes expected to be run by the company)**

| Process name | Transport mode | Default (per FU) | | | Default dataset | Dataset source | UUID | Default DQR | | | | Most relevant [Y/N] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Distance | Utilisation ratio | Empty return | | | | P | TiR | GR | TeR | |
| Transport to local supply chain | Truck | 1200 | 64 | no | Articulated lorry transport, Euro 4, Total weight >32 t (without fuel) | http://lcdn.thinkstep.com/Node/ | 938d5ba6-17e4-4f0d-bef0-481608681f57 | 2 | 1 | 2 | 2 | N |
| Transport to international supply chain | Truck | 1000 | 64 | no | Articulated lorry transport, Euro 4, Total weight >32 t (without fuel) | http://lcdn.thinkstep.com/Node/ | 938d5ba6-17e4-4f0d-bef0-481608681f57 | 2 | 1 | 2 | 2 | N |
| | Ship (transoeanic container) | 18000 | - | no | Transoceanic ship, containers heavy fuel oil driven, cargo consumption mix, to consumer 27.500 dwt | http://lcdn.thinkstep.com/Node/ | 6ca61112-1d5b-473c-abfa-4accc66a8a63 | 1 | 2 | 2 | 2 | N |
| Transport from retail to final client | Passenger car | 5 | 0.0037 | no | Passenger car, average technology mix, | http://lcdn.thinkstep.com/Node/ | 1ead35dd-fc71-4b0c-9410- | 1 | 3 | 3 | 2 | N |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | gasoline and diesel driven, Euro 3-5, passenger car consumption mix, to consumer engine size from 1,4l up to >2l | | 7e39da95c7dc | | | | | |
| | Van | 5 | 20 | no | Articulated lorry transport, Euro 3, Total weight <7.5 t (without fuel) diesel driven, Euro 3, cargo consumption mix, to consumer up to 7,5t gross weight / 3,3t payload capacity | http://lcdn.thinkstep.com/Node/ | aea613ae-573b-443a-aba2-6a69900ca2ff | 1 | 1 | 1 | 2 | N |

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

The waste of products during the distribution and retail shall be included in the modelling. 1% default loss rate shall be considered for as the overall consolidated value for transportation, storage and retail.

## 6.5. Use stage

The use stage starts at the moment the end user consumes wine and till the product enters its end-of-life stage. It includes activities and products needed for a proper consumption of wine:

- Product-independent processes (the same for all wine products even if the producer changes the product’s characteristics): use of glass for drinking wine. As wine does not determine a difference in glass use, processes associated to drinking glasses are excluded from the system boundaries.
- Product dependent processes: recommended serving temperature for wine. May be relevant for some impact categories and therefore shall be included in the system boundaries.

To model the use stage processes the main function approach shall be applied.

As a default scenario, cooling of the product before its consumption will be considered for sparkling and still wines (red, white or rosé) whenever the serving temperature inferior to ambient temperature. In all cases, an energy consumption of 0.0037 kWh/l/day and 7 days of storage in the fridge until wine is completely consumed shall be applied. When calculating the energy consumption, the volume occupied by the product in the fridge shall be considered. It is assumed that the storage volume is 3 times the packaged volume (e.g. 0.75 l of wine (still or sparkling) requires 2.25 l of storage volume in the fridge). Different conditions should be assessed in a sensitivity analysis if different values are justified.

The following table lists all processes taking place in the scenario.

**Table 20. Use stage (consumption)**

| **Name of the process** | **Unit of measurement (output)** | **Default amount per FU** | **Default dataset to be used** | **Dataset source** | **UUID** | **Default DQR** | | | | **Most relevant process [Y/N]** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | P | TiR | GR | TeR | |
| Electricity consumption | kWh | 0.062 | Electricity grid mix 1kV-60kV AC, technology mix consumption mix, at consumer 1kV - 60kV | http://lcdn.thinkstep.com/Node/ | 34960d4d-af62-43a0-aa76-adc5fcf57246 | 2 | 1 | 1 | 1 | N |

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

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

The waste of products during the use stage shall be included in the modelling. As a default scenario 5% product-losses during the use phase shall be considered, including those related to the alteration of the wine taste, among others (e.g. losses at restaurants). Therefore an additional amount of packaged wine shall be produced and transported to compensate these losses and meet the functional unit. Different product-losses rates should be considered in a sensitivity analysis if different values are justified. It will be considered that lost wine and left-overs are poured down the drain (and therefore treated as waste water) as part of the end-of-life stage.

## 6.6. End of life

The End-of-Life stage is a life cycle stage that in general includes the waste of the product in scope, such as the food waste, primary packaging, or the product left at its end of use.

It will be considered that wine lost or not consumed will be poured down the drain and treated as waste water. The transport of primary packaging waste from collection place to EOL treatment is included in the landfill, incineration and recycling datasets.

The following table lists all processes taking place in the scenario.

**Table 21. End of Life (capitals indicate those processes expected to be run by the company)**

| Name of the process | Unit of measurement (output) | Default amount per FU | Default dataset to be used | Dataset source | UUID | Default DQR | | | | Most relevant process [Y/N] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | P | TiR | GR | TeR | |
| Product losses (5%) | liters | 0.037 | Treatment of residential wastewater, large plant | http://lcdn.thinkstep.com/Node/ | f5ec4a19-70da-406d-be31-a7eeef2f8372 | 2 | 2 | 2 | 2 | N |
| Glass bottle – recycling | kg | Company specific | Container glass, ER, Recycled Content 100% (provided by FEVE) | URL: http://soda.rdc.yp5.be/login.xhtml?stock=FEVE_EF_comp | AB4E945F-9955-4414-B3FB-D42507CC4E2D | 2 | 2 | 2 | 2 | Y |
| Glass bottle – waste incineration | kg | Company specific | Waste incineration of municipal solid waste | http://lcdn.thinkstep.com/Node/ | 2f07be1f-d11a-46ac-b4f0-49c5f28b5b93 | 1 | 2 | 1 | 2 | N |
| Glass bottle - landfill | kg | Company specific | Landfill of inert (glass) landfill | http://lcdn.thinkstep.com/Node/ | b0eacfd4-181b-4d31-8de3-09f2b0513dce | 2 | 2 | 2 | 2 | N |
| Cork stopper – recycling | kg | Company specific | Softwood forestry non-sustainable managed at forest per kg wood | https://lcdn.quantis-software.com/PEF/ | cdd64c25-3876-44fc-8ba2-27c6c85a0cd1 | 2,0 | 2,0 | 2,9 | 2,0 | N |
| Cork stopper – incineration | kg | Company specific | Waste incineration of untreated wood | http://lcdn.thinkstep.com/Node/ | a1ae691d-268e-4ba6-b4e6-f3b7263fd17b | 1 | 2 | 1 | 2 | N |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cork stopper-landfill | kg | Company specific | Landfill of untreated wood landfill | http://lcdn.thinkstep.com/Node/ | 8fd8211a-135d-4921-aaeb-e2e5100bac2e | 2 | 2 | 2 | 2 | N |
| Aluminium – recycling | kg | Company specific | Recycling of aluminium into aluminium scrap - from post-consumer | http://lcdn.thinkstep.com/Node/ | c4f3bfde-c15f-4f7f-8d35-bed6241704db | 2 | 2 | 2 | 2 | N |
| Aluminium – incineration | kg | Company specific | Waste incineration of non-ferro metals, aluminium | http://lcdn.thinkstep.com/Node/ | f2c7614e-a50c-4f77-b49c-76472649acd6 | 1 | 2 | 1 | 2 | N |
| Aluminium - landfill | kg | Company specific | Landfill of inert (aluminium) | http://lcdn.thinkstep.com/Node/ | 3f7d5e8a-a112-4585-9e2f-dc8b667d66dc | 2 | 2 | 2 | 2 | N |
| Paper– recycling | kg | Company specific | Kraft paper, bleached production mix at plant per kg paper | https://lcdn.quantis-software.com/PEF/ | b5e2916f-cd5d-40da-8b5f-29e4997fc087 | 2,6 | 2 | 2 | 2 | N |
| Paper – incineration | kg | Company specific | Waste incineration of paper and board | http://lcdn.thinkstep.com/Node/ | b6ce954d-deb4-4c16-907a-c67b71e1e862 | 1 | 2 | 1 | 2 | N |
| Paper - landfill | kg | Company specific | Landfill of paper and paperboard | http://lcdn.thinkstep.com/Node/ | 86ff0001-4794-4df5-a1d4-083a9d986b62 | 2 | 2 | 2 | 2 | N |
| Plastic recycling | kg | Company specific | Cast film extrusion plastic extrusion production mix | http://lcdn.thinkstep.com/Node/ | f6b31664-d8a5-44f3-b91c-a71f9025bdc5 | 3 | 2 | 3 | 2 | N |
| Plastic (PE, PP, PS, PB) incineration | kg | Company specific | Waste incineration of PE waste | http://lcdn.thinkstep.com/Node/ | 0370baaf-8923-4e26-b3b8-abcebb89f974 | 1 | 2 | 1 | 2 | N |
| Plastic (PET, PMMA, PC) incineration | kg | Company specific | Waste incineration of PET waste | http://lcdn.thinkstep.com/Node/ | 773b8f01-2263-4d3d-a6f9-11dd316d4a58 | 1 | 2 | 1 | 2 | N |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Plastic landfill | kg | Company specific | Landfill of plastic waste landfill | http://lcdn.thinkstep.com/Node/ | f2bea0f5-e4b7-4a2c-9f34-4eb32495cbc6 | 2 | 2 | 2 | 2 | N |

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

The end of life shall be modelled using the formula and guidance provided in chapter 5.11. Modelling of wastes and recycled content of this PEFCR. Applying the CFF formula for packaging waste in the scope of this PEFCR, the values of the parameters listed in Table 16 (chapter 6.1.1) shall be used. Default R2 values are based on the PEF Guidance and the B value shall be equal to 0 as default.

Before selecting the appropriate $R_2$ value, an evaluation for recyclability of the material shall be done and the PEF study shall include a statement on the recyclability of the materials/products. The statement on the recyclability shall be provided together with an evaluation for recyclability that includes evidence for the following three criteria (as described by ISO 14021:1999, section 7.7.4 'Evaluation methodology'):

1. The collection, sorting and delivery systems to transfer the materials from the source to the recycling facility are conveniently available to a reasonable proportion of the purchasers, potential purchasers and users of the product;
2. The recycling facilities are available to accommodate the collected materials;
3. Evidence is available that the product for which recyclability is claimed is being collected and recycled.

Point 1 and 3 can be proven by recycling statistics (country specific) derived from industry associations or national bodies. Approximation to evidence at point 3 can be provided by applying for example the design for recyclability evaluation outlined in EN 13430 Material recycling (Annexes A and B) or other sector-specific recyclability guidelines if available[24].

Following the evaluation for recyclability, the appropriate $R_2$ values (supply-chain specific or default) shall be used. If one criterion is not fulfilled or the sector-specific recyclability guidelines indicate a limited recyclability an $R_2$ value of 0% shall be applied.

Company-specific $R_2$ values (measured at the output of the recycling plant) shall be used when available. If no company-specific values are available and the criteria for evaluation of recyclability are fulfilled (see below), application-specific $R_2$ values shall be used as listed in the table below,

- If an $R_2$ value is not available for a specific country, then the European average shall be used.
- If an $R_2$ value is not available for a specific application, the $R_2$ values of the material shall be used (e.g. materials average).

[24] E.g. the EPBP design guidelines (http://www.epbp.org/design-guidelines), or Recyclability by design (http://www.recoup.org/)

- In case no $R_2$ values are available, $R_2$ shall be set equal to 0 or new statistics may be generated in order to assign an $R_2$ value in the specific situation.

The applied $R_2$ values shall be subject to the PEF study verification.

# 7 PEF results

## 7.1. Benchmark values

The following tables show the benchmarks for the two representative products.

Additional benchmarks are also provided in Annex X for those cases where the use of glass bottles is required for still wine. In such cases the comparison against this second benchmark may be included as an annex of the PEF study .

***Table 22. - Characterised benchmark values for still wine***

| Impact category | Unit | Life cycle excl. use stage | Use stage |
|---|---|---|---|
| **Climate change** | kg $CO_{2\ eq}$ | 1.50E+00 | 8.39E-02 |
| *Climate change - biogenic* | | 1.10E-01 | 1.64E-03 |
| *Climate change – land use and land transformation* | | 1.40E-03 | 8.74E-05 |
| **Ozone depletion** | kg CFC-11 $_{eq}$ | 3.60E-08 | 1.17E-10 |
| **Particulate matter** | disease incidence | 8.60E-08 | 2.46E-09 |
| **Ionising radiation, human health** | kBq $U^{235}{}_{eq}$ | 1.30E-01 | 3.10E-02 |
| **Photochemical ozone formation, human health** | kg NMVOC $_{eq}$ | 4.44E-03 | 1.32E-04 |
| **Acidification** | mol H+ $_{eq}$ | 8.54E-03 | 2.51E-04 |
| **Eutrophication, terrestrial** | mol N $_{eq}$ | 2.48E-02 | 4.66E-04 |
| **Eutrophication, freshwater** | kg P $_{eq}$ | 1.58E-04 | 2.60E-06 |
| **Eutrophication, marine** | kg N $_{eq}$ | 4.34E-03 | 7.32E-05 |
| **Land use** | Dimensionless (pt) | 1.57E+02 | 2.85E-01 |
| **Water use** | $m^3$ world $_{eq}$ | 8.78E-01 | 7.01E-02 |
| **Resource use, minerals and metals** | kg Sb $_{eq}$ | 1.51E-05 | 9.95E-09 |
| **Resource use, fossils** | MJ | 1.75E+01 | 1.33E+00 |

***Table 23. - Characterised benchmark values for sparkling wine***

| Impact category | Unit | Life cycle excl. use stage | Use stage |
|---|---|---|---|
| **Climate change** | kg $CO_{2\ eq}$ | 2.1E+00 | 8.1E-02 |
| *Climate change - biogenic* | | 9.0E-02 | 1.5E-03 |
| *Climate change – land use and land transformation* | | 1.5E-03 | 8.8E-05 |
| **Ozone depletion** | kg CFC-11 $_{eq}$ | 3.1E-08 | 1.4E-10 |
| **Particulate matter** | disease incidence | 9.7E-08 | 2.4E-09 |
| **Ionising radiation, human health** | kBq $U^{235}{}_{eq}$ | 1.8E-01 | 3.1E-02 |
| **Photochemical ozone formation, human health** | kg NMVOC $_{eq}$ | 3.6E-03 | 1.3E-04 |
| **Acidification** | mol H+ $_{eq}$ | 8.7E-03 | 2.5E-04 |
| **Eutrophication, terrestrial** | mol N $_{eq}$ | 2.2E-02 | 5.1E-04 |
| **Eutrophication, freshwater** | kg P $_{eq}$ | 1.4E-04 | 2.7E-06 |
| **Eutrophication, marine** | kg N $_{eq}$ | 3.7E-03 | 7.3E-05 |

| Impact category | Unit | Life cycle excl. use stage | Use stage |
|---|---|---|---|
| **Land use** | Dimensionless (pt) | 1.5E+02 | 6.6E-01 |
| **Water use** | $m^3$ world $_{eq}$ | 2.9E+00 | 7.1E-02 |
| **Resource use, minerals and metals** | kg Sb $_{eq}$ | 1.3E-05 | 4.0E-08 |
| **Resource use, fossils** | MJ | 2.6E+01 | 1.3E+00 |

***Table 24. - Normalised benchmark values for still wine***

| Impact category | Life cycle excl. use stage | Use stage |
|---|---|---|
| **Climate change** | 1,89E-04 | 1,04E-05 |
| **Ozone depletion** | 1,55E-06 | 5,89E-09 |
| **Particulate matter** | 1,34E-04 | 3,79E-06 |
| **Ionising radiation, human health** | 3,36E-05 | 7,30E-06 |
| **Photochemical ozone formation, human health** | 1,09E-04 | 3,22E-06 |
| **Acidification** | 1,54E-04 | 4,44E-06 |
| **Eutrophication, terrestrial** | 1,40E-04 | 2,86E-06 |
| **Eutrophication, freshwater** | 6,21E-05 | 1,08E-06 |
| **Eutrophication, marine** | 1,53E-04 | 2,60E-06 |
| **Land use** | 1,18E-04 | 4,97E-07 |
| **Water use** | 7,63E-05 | 6,10E-06 |
| **Resource use, minerals and metals** | 2,61E-04 | 6,85E-07 |
| **Resource use, fossils** | 2,67E-04 | 2,02E-05 |

***Table 25. - Normalised benchmark values for sparkling wine***

| Impact category | Life cycle excl. use stage | Use stage |
|---|---|---|
| **Climate change** | 2,71E-04 | 1,04E-05 |
| **Ozone depletion** | 1,34E-06 | 5,89E-09 |
| **Particulate matter** | 1,52E-04 | 3,79E-06 |
| **Ionising radiation, human health** | 4,48E-05 | 7,30E-06 |
| **Photochemical ozone formation, human health** | 8,80E-05 | 3,22E-06 |
| **Acidification** | 1,57E-04 | 4,44E-06 |
| **Eutrophication, terrestrial** | 1,26E-04 | 2,86E-06 |
| **Eutrophication, freshwater** | 5,55E-05 | 1,06E-06 |
| **Eutrophication, marine** | 1,32E-04 | 2,59E-06 |
| **Land use** | 1,11E-04 | 5,00E-07 |
| **Water use** | 2,49E-04 | 6,14E-06 |
| **Resource use, minerals and metals** | 2,26E-04 | 6,85E-07 |
| **Resource use, fossils** | 3,95E-04 | 2,02E-05 |

*Table 26. - Weighted benchmark values for still wine*

| Impact category | Life cycle excl. use stage | Use stage |
|---|---|---|
| **Climate change** | 4,20E-05 | 2,31E-06 |
| **Ozone depletion** | 1,04E-07 | 3,97E-10 |
| **Particulate matter** | 1,28E-05 | 3,61E-07 |
| **Ionising radiation, human health** | 1,80E-06 | 3,92E-07 |
| **Photochemical ozone formation, human health** | 5,56E-06 | 1,64E-07 |
| **Acidification** | 1,02E-05 | 2,95E-07 |
| **Eutrophication, terrestrial** | 5,48E-06 | 1,12E-07 |
| **Eutrophication, freshwater** | 1,83E-06 | 3,19E-08 |
| **Eutrophication, marine** | 4,78E-06 | 8,11E-08 |
| **Land use** | 9,92E-06 | 4,18E-08 |
| **Water use** | 6,89E-06 | 5,51E-07 |
| **Resource use, minerals and metals** | 2,11E-05 | 5,53E-08 |
| **Resource use, fossils** | 2,38E-05 | 1,80E-06 |
| **TOTAL** | **1,46E-04** | **6,20E-06** |

*Table 27. - Weighted benchmark values for sparkling wine*

| Impact category | Life cycle excl. use stage | Use stage |
|---|---|---|
| **Climate change** | 6,02E-05 | 2,31E-06 |
| **Ozone depletion** | 9,07E-08 | 3,97E-10 |
| **Particulate matter** | 1,45E-05 | 3,62E-07 |
| **Ionising radiation, human health** | 2,40E-06 | 3,92E-07 |
| **Photochemical ozone formation, human health** | 4,49E-06 | 1,64E-07 |
| **Acidification** | 1,04E-05 | 2,95E-07 |
| **Eutrophication, terrestrial** | 4,94E-06 | 1,12E-07 |
| **Eutrophication, freshwater** | 1,64E-06 | 3,14E-08 |
| **Eutrophication, marine** | 4,12E-06 | 8,09E-08 |
| **Land use** | 9,32E-06 | 4,21E-08 |
| **Water use** | 2,25E-05 | 5,54E-07 |
| **Resource use, minerals and metals** | 1,82E-05 | 5,53E-08 |
| **Resource use, fossils** | 3,52E-05 | 1,80E-06 |
| **TOTAL** | **1,88E-04** | **6,20E-06** |

## 7.2. PEF profile

The applicant shall calculate the PEF profile of its product in compliance with all requirements included in this PEFCR. The following information shall be included in the PEF report:

- full life cycle inventory;
- characterised results in absolute values, for all impact categories (including toxicity; as a table);
- normalised and weighted results in absolute values, for all impact categories (including toxicity; as a table);
- the aggregated single score in absolute values.

Together with the PEF report, the applicant shall develop an aggregated EF-compliant dataset of its product in scope and the DQR of this dataset shall be calculated and reported in the EF report. This dataset shall be made available on the EF node ( http://eplca.jrc.ec.europa.eu/EF-node). The disaggregated version may stay confidential.

## 7.3. Additional technical information

Not applicable for this PEFCR.

## 7.4. Additional environmental information

Ecotoxicity and biodiversity are important issues in wine production and, specially, during grape production.

### 7.4.1. Biodiversity

Biodiversity is considered as relevant for this PEFCR: **Yes**

Depending on production practices, grape production may have either positive or negative impact on biodiversity. As the methodology to assess biodiversity impacts is still evolving, different approaches may be applied. The ReCiPe score for biodiversity (Goedkoop et al., 2009) which translates mid-point impacts into species lost for a period of time is recommended.

In addition, others approaches are also allowed, for instance by providing evidence over the impact of grape production (or other processes and life cycle stages) on levels of biodiversity, as for example those run by Biodiversity Friend certification[25] and Viticulture Durable en Champagne[26] and Forest Stewardship Council[27].

In any case, if an assessment on biodiversity impact is included in the PEF study, the used methodology shall be reported.

### 7.4.2. Organic grape and participation in relevant certification schemes

The use of grapes coming from verified organic production and/or the participation of the company into sustainability certification schemes (such as the Italian VIVA Vino[28], the Viticulture Durable en Champagne or Wineries for Climate Protection[29]) shall be declared as additional environmental information as % in mass of the total grape used.

### 7.4.3. Recycled content of primary packaging materials

Whereas default R1 values are stated in this PEFCR for packaging materials, applicants may declare as additional environmental information the recycled content of the primary packaging materials used (e.g. container, stoppers, labels, etc.). This recycled content shall be considered as the proportion of material (% in mass) in the input to the production that has been recycled from a previous system. Signed statements of the corresponding packaging providers shall be used to prove the supply-chain-specific recycled content value. It shall be clearly stated to which packaging part the declaration refers to.

[25] Biodiversity Friend is a standard certification developed in 2010 by World Biodiversity Association to evaluate the biodiversity and promote its conservation in agriculture (www.biodiversityfriend.org).
[26] Viticulture Durable en Champagne is a certification created in 2014 which includes external auditing of 123 criteria including "biodiversity-friendly" actions.
[27] https://us.fsc.org/en-us
[28] http://www.viticolturasostenibile.org/Home.aspx
[29] http://www.wineriesforclimateprotection.com

# 8 Verification

The verification of an EF study/report carried out in compliance with this PEFCR shall be done according to all the general requirements included in Section 8 of the PEFCR Guidance 6.3. and the requirements listed below.

The verifier(s) shall verify that the EF study is conducted in compliance with this PEFCR.

These requirements will remain valid until an EF verification scheme is adopted at European level or alternative verification approaches applicable to EF studies/report are included in existing or new policies.

The verifier(s) shall validate the accuracy and reliability of the quantitative information used in the calculation of the study. As this can be highly resource intensive, the following requirements shall be followed:

- The verifier shall check if the correct version of all impact assessment methods was used. For each of the most relevant impact categories, at least 50% of the characterisation factors (for each of the most relevant EF impact categories) shall be verified, while all normalisation and weighting factors of all ICs shall be verified. In particular, the verifier shall check that the characterisation factors correspond to those included in the EF impact assessment method the study declares compliance with[30];
- All the newly created datasets shall be checked on their EF compliancy (for the meaning of EF compliant datasets refer to Annex H of the Guidance). All their underlying data (elementary flows, activity data and sub processes) shall be validated;
- The aggregated EF-compliant dataset of the product in scope (meaning, the EF study) is available on the EF node (http://eplca.jrc.ec.europa.eu/EF-node).
- For at least 70% of the most relevant processes in situation 2 option 2 of the DNM, 70% of the underlying data shall be validated. The 70% data shall including all energy and transport sub processes for those in situation 2 option 2;
- For at least 60% of the most relevant processes in situation 3 of the DNM, 60% of the underlying data shall be validated;
- For at least 50% of the other processes in situation 1, 2 and 3 of the DNM, 50% of the underlying data shall be validated.

In particular, it shall be verified for the selected processes if the DQR of the process satisfies the minimum DQR as specified in the DNM.

The selection of the processes to be verified for each situation shall be done ordering them from the most contributing to the less contributing one and selecting those contributing up to the identified percentage starting from the most contributing ones. In case of non-integer numbers, the rounding shall be made always considering the next upper integer.

These data checks shall include, but should not be limited to, the activity data used, the selection of secondary sub-processes, the selection of the direct elementary flows and the CFF parameters. For example, if there are 5 processes and each one of them includes 5 activity

[30] Available at: http://eplca.jrc.ec.europa.eu/LCDN/developer.xhtml

data, 5 secondary datasets and 10 CFF parameters, then the verifier(s) has to check at least 4 out of 5 processes (70%) and, for each process, (s)he shall check at least 4 activity data (70% of the total amount of activity data), 4 secondary datasets (70% of the total amount of secondary datasets), and 7 CFF parameters (70% of the total amount of CFF parameters), i.e. the 70% of each of data that could be possible subject of check.

The verification of the EF report shall be carried out by randomly checking enough information to provide reasonable assurance that the EF report fulfils all the conditions listed in section 8 of the PEFCR Guidance.

# 9 References

Beverage Industry Sector Guidance for Greenhouse Gas Emissions Reporting. Beverage Industry Environmental Roundtable. Version 3.0, December 2013.

BP X 30-323-0 «General principles for an environmental communication on mass market products» developed by AFNOR. Part 15: Methodology for the environmental impacts assessment of food products (2012-10-22)

ENVIFOOD Protocol. Environmental Assessment of Food and Drink Protocol. European Food Sustainable Consumption & Production RoundTable. November 2013.

European Commission (2013). Annex II: Product Environmental Footprint (PEF) Guide to the Commission Recommendation on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations (2013/179/EU).

European Commission (2017). *PEFCR Guidance document* – Guidance for the development of Product Environmental Footprint Category Rules (PEFCRs), version 6.3, December 2017.

General principles of the OIV GHG accounting protocol (GHGAP) for the vine and wine sector.

Goedkoop, M., Heijungs, R., Huijbregts, M., Schryver, A. De, Struijs, J., & Zelm, R. Van. (2009). ReCiPe 2008 A life cycle assessment method which comprises harmonised category indicators at the midpoint and the endpoint level. Report 1 Characterisation. Den Haag.

ISO 14040, ISO 14044 and ISO 14071 on Life Cycle Assessment.

PCR 2010:02 Wine of fresh grapes, except sparkling wine; grape must (Version 1.03). The International EPD System.

PCR 2014:14 Sparkling wine of fresh grapes (Version 1.0). The International EPD System.

Product Category Rules for wine. HAproWINE Life Project. Approval: November 2013. LIFE08 ENV/E/000143.

# 10 ANNEX 1 – List of EF normalisation and weighting factors

Global normalisation factors are applied within the EF. The normalisation factors as the global impact per person are used in the EF calculations.

| Impact category | Unit | Normalisation factor | Normalisation factor per person | Impact assessment robustness | Inventory coverage completeness | Inventory robustness | Comment |
|---|---|---|---|---|---|---|---|
| **Climate change** | kg $CO_{2\ eq}$ | 5.35E+13 | 7.76E+03 | I | II | I | |
| **Ozone depletion** | kg CFC-11 $_{eq}$ | 1.61E+08 | 2.34E-02 | I | III | II | |
| **Human toxicity, cancer** | CTUh | 2.66E+05 | 3.85E-05 | II/III | III | III | |
| **Human toxicity, non-cancer** | CTUh | 3.27E+06 | 4.75E-04 | II/III | III | III | |
| **Particulate matter** | disease incidence | 4.39E+06 | 6.37E-04 | I | I/II | I /II | NF calculation takes into account the emission height both in the emission inventory and in the impact assessment. |
| **Ionising radiation, human health** | kBq $U^{235}{}_{eq}$ | 2.91E+13 | 4.22E+03 | II | II | III | |
| **Photochemical ozone formation, human health** | kg NMVOC $_{eq}$ | 2.80E+11 | 4.06E+01 | II | III | I/II | |
| **Acidification** | mol H+ $_{eq}$ | 3.83E+11 | 5.55E+01 | II | II | I/II | |
| **Eutrophication, terrestrial** | mol N $_{eq}$ | 1.22E+12 | 1.77E+02 | II | II | I/II | |
| **Eutrophication, freshwater** | kg P $_{eq}$ | 1.76E+10 | 2.55E+00 | II | II | III | |
| **Eutrophication, marine** | kg N $_{eq}$ | 1.95E+11 | 2.83E+01 | II | II | II/III | |
| **Land use** | pt | 9.20E+15 | 1.33E+06 | III | II | I I | The NF is built by means of regionalised CFs. |
| **Ecotoxicity, freshwater** | CTUe | 8.15E+13 | 1.18E+04 | II/III | III | III | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Water use** | $m^3$ world $_{eq}$ | 7.91E+13 | 1.15E+04 | III | I | II | The NF is built by means of regionalised CFs. |
| **Resource use, fossils** | MJ | 4.50E+14 | 6.53E+04 | III | I | II | |
| **Resource use, minerals and metals** | kg Sb $_{eq}$ | 3.99E+08 | 5.79E-02 | III | | | |

## Weighting factors for Environmental Footprint

| | **Aggregated weighting set** | **Robustness factors** | **Calculation** | **Final weighting factors** |
|---|---|---|---|---|
| | **(50:50)** | **(scale 1-0.1)** | | |
| **WITHOUT TOX CATEGORIES** | **A** | **B** | **C=A*B** | **C scaled to 100** |
| Climate change | 15.75 | 0.87 | 13.65 | **22.19** |
| Ozone depletion | 6.92 | 0.6 | 4.15 | **6.75** |
| Particulate matter | 6.77 | 0.87 | 5.87 | **9.54** |
| Ionizing radiation, human health | 7.07 | 0.47 | 3.3 | **5.37** |
| Photochemical ozone formation, human health | 5.88 | 0.53 | 3.14 | **5.1** |
| Acidification | 6.13 | 0.67 | 4.08 | **6.64** |
| Eutrophication, terrestrial | 3.61 | 0.67 | 2.4 | **3.91** |
| Eutrophication, freshwater | 3.88 | 0.47 | 1.81 | **2.95** |
| Eutrophication, marine | 3.59 | 0.53 | 1.92 | **3.12** |
| Land use | 11.1 | 0.47 | 5.18 | **8.42** |
| Water use | 11.89 | 0.47 | 5.55 | **9.03** |
| Resource use, minerals and metals | 8.28 | 0.6 | 4.97 | **8.08** |
| Resource use, fossils | 9.14 | 0.6 | 5.48 | **8.92** |

# 11 ANNEX 2 - Check-list for the PEF study

*Each PEF study shall include this annex, completed with all the requested information.*

| ***ITEM*** | ***Included in the PEF study (Y/N)*** | ***Section of the PEF study in which the item is included*** | ***Page of the PEF study in which the item is included*** |
|---|---|---|---|
| *Summary* | | | |
| *General information about the product* | | | |
| *General information about the company* | | | |
| *Diagram with system boundary and indication of the situation according to DNM* | | | |
| *List and description of processes included in the system boundaries* | | | |
| *List of co-products, by-products and waste* | | | |
| *List of activity data used* | | | |
| *List of secondary datasets used* | | | |
| *Data gaps* | | | |
| *Assumptions* | | | |
| *Scope of the study* | | | |
| *(sub)category to which the product belongs* | | | |
| *DQR calculation of each dataset used for the most relevant processes and the new ones created.* | | | |

| ***ITEM*** | ***Included in the PEF study (Y/N)*** | ***Section of the PEF study in which the item is included*** | ***Page of the PEF study in which the item is included*** |
|---|---|---|---|
| *DQR (of each criteria and total) of the study* | | | |
| *Environmental additional information* | | | |

# 12 ANNEX 3 - Critical review report of the PEFCR

See pdf file: PEFCR-WINE_Annex 3_ReviewReport_2018_03_23 available at http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR.htm

# 13 ANNEX 4 – Sampling procedure

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

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

Using a stratified sample will always achieve greater precision than a simple random sample, provided that the sub-populations have been chosen so that the items of the same sub-population are as similar as possible in terms of the characteristics of interest. In addition, a stratified sample guarantees better coverage of the population. The researcher has control over the sub-populations that are included in the sample, whereas simple random sampling does not guarantee that sub-populations (strata) of a given population are each adequately represented within the final sample. However, one main disadvantage of stratified sampling is that it can be difficult to identify appropriate sub-populations for a population.

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

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

## 13.1. How to define homogenous sub-populations (stratification)

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

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

- Geographical distribution of sites.
- Technologies/farming practices involved.

- Production capacity of the companies/sites taken into consideration.

The number of sub-populations may be identified as:

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

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

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

**Example 1**

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

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

In this case:

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

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

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

**Example 2**

350 farmers are distributed in three different countries (100 in Spain, 200 in France and 50 in Germany). There are two different harvesting techniques that are used that differ in a relevant way (Spain: 70 technique A, 30 technique B; France: 100 technique A, 100 technique B; Germany: 50 technique A). The capacity of the farmers in term of annual production varies between 10,000t and 100,000t. According to expert judgement/relevant literature, it has been estimated that farmers with an annual production lower than 50,000t are completely different in terms of efficiency compared to the farmers with an annual production higher than 50,000t. Two classes of companies are defined based on the annual production: class 1, if production is lower than 50,000t and class 2, if production if higher than 50,000t. (Spain: 80 class 1, 20 class 2; France: 50 class 1, 150 class 2; Germany: 50 class 1). In the following table are included the details about the population.

**Table 28. Identification of the sub-population for Example 2.**

| Sub-population | Country | | Technology | | Capacity | |
|---|---|---|---|---|---|---|
| 1 | Spain | 100 | Technique A | 70 | Class 1 | 50 |
| 2 | Spain | | Technique A | | Class 2 | 20 |
| 3 | Spain | | Technique B | 30 | Class 1 | 30 |
| 4 | Spain | | Technique B | | Class 2 | 0 |
| 5 | France | 200 | Technique A | 100 | Class 1 | 20 |
| 6 | France | | Technique A | | Class 2 | 80 |
| 7 | France | | Technique B | 100 | Class 1 | 30 |
| 8 | France | | Technique B | | Class 2 | 70 |
| 9 | Germany | 50 | Technique A | 50 | Class 1 | 50 |
| 10 | Germany | | Technique A | | Class 2 | 0 |
| 11 | Germany | | Technique B | 0 | Class 1 | 0 |
| 12 | Germany | | Technique B | | Class 2 | 0 |

In this case:

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

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

It is possible to identify maximum 12 sub-populations that are summarized in the following table:

**Table 29. Summary of the sub-population for example 2.**

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

## 13.2. How to define sub-sample size at sub-population level

Once the sub-populations have been identified, for each sub-population the size of sample shall be calculated (the sub-sample size) based on the number of sites/farms/plants involved in the sub-population. The required sub-sample size shall be calculated using the square root of the sub-population size.

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

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

**Example**

**Table 30. Example – how to calculate the number of companies in each sub-sample.**

| Sub-population | Country | Technology | Capacity | Number of companies in the sub-population | Number of companies in the sample (sub-sample size, [$n_{SS}$]) |
|---|---|---|---|---|---|
| 1 | Spain | Technique A | Class 1 | 50 | 7 |
| 2 | Spain | Technique A | Class 2 | 20 | 5 |
| 3 | Spain | Technique B | Class 1 | 30 | 6 |
| 4 | Spain | Technique B | Class 2 | 0 | 0 |
| 5 | France | Technique A | Class 1 | 20 | 5 |
| 6 | France | Technique A | Class 2 | 80 | 9 |
| 7 | France | Technique B | Class 1 | 30 | 6 |
| 8 | France | Technique B | Class 2 | 70 | 8 |
| 9 | Germany | Technique A | Class 1 | 50 | 7 |
| 10 | Germany | Technique A | Class 2 | 0 | 0 |
| 11 | Germany | Technique B | Class 1 | 0 | 0 |
| 12 | Germany | Technique B | Class 2 | 0 | 0 |

## 13.3. How to define the sample for the population

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

## 13.4. What to do in case rounding is necessary

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

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

# 14 ANNEX 5 – Additional benchmark for still wine packaged in glass bottles

***Additional characterised benchmark for still wine if the use of glass bottles is compulsory***

| Impact category | Unit | Life cycle excl. use stage | Use stage |
|---|---|---|---|
| **Climate change** | kg $CO_{2\ eq}$ | 1,64E+00 | 8,52E-02 |
| *Climate change - biogenic* | | 1,13E-01 | 1,63E-03 |
| *Climate change – land use and land transformation* | | 1,48E-03 | 9,30E-05 |
| **Ozone depletion** | kg CFC-11 $_{eq}$ | 3,62E-08 | 1,45E-10 |
| **Particulate matter** | disease incidence | 9,24E-08 | 2,54E-09 |
| **Ionising radiation, human health** | kBq $U^{235}{}_{eq}$ | 1,56E-01 | 3,25E-02 |
| **Photochemical ozone formation, human health** | kg NMVOC $_{eq}$ | 4,59E-03 | 1,38E-04 |
| **Acidification** | mol H+ $_{eq}$ | 9,10E-03 | 2,60E-04 |
| **Eutrophication, terrestrial** | mol N $_{eq}$ | 2,58E-02 | 5,33E-04 |
| **Eutrophication, freshwater** | kg P $_{eq}$ | 1,59E-04 | 2,91E-06 |
| **Eutrophication, marine** | kg N $_{eq}$ | 4,40E-03 | 7,75E-05 |
| **Land use** | Dimensionless (pt) | 1,56E+02 | 6,96E-01 |
| **Water use** | $m^3$ world $_{eq}$ | 1,27E+00 | 7,39E-02 |
| **Resource use, minerals and metals** | kg Sb $_{eq}$ | 1,47E-05 | 4,17E-08 |
| **Resource use, fossils** | MJ | 1,96E+01 | 1,39E+00 |

# 15 ANNEX 6 – Carbon storage modelling

Organic residues (mainly leaves and stocks) deposited in the vineyard soil contribute to increase its permanent organic carbon stock. In addition, vines contribute to carbon sequestration in their permanent structure during long periods..

Carbon permanently stored in the soil and tree biomass of cork oak forests and vines shall be taken into account if this storage goes beyond 100 years. The following methods shall be applied for calculating a) carbon permanently stored in the soil and/or b) biogenic carbon sequestration in permanent structure. Results shall be reported under the impact sub-category Climate Change - biogenic.

## 14.1. Carbon permanently stored at soil (vineyards and oak forests)

The **process-based approach** shall be used to estimate the carbon credits if the producer proves that carbon storage beyond 100 years occur at the oak forests and/or the vineyard. This process considers the organic carbon stock changes in mineral soils and estimates the net balance of additions to and subtraction from a carbon stock (see Figure 4).

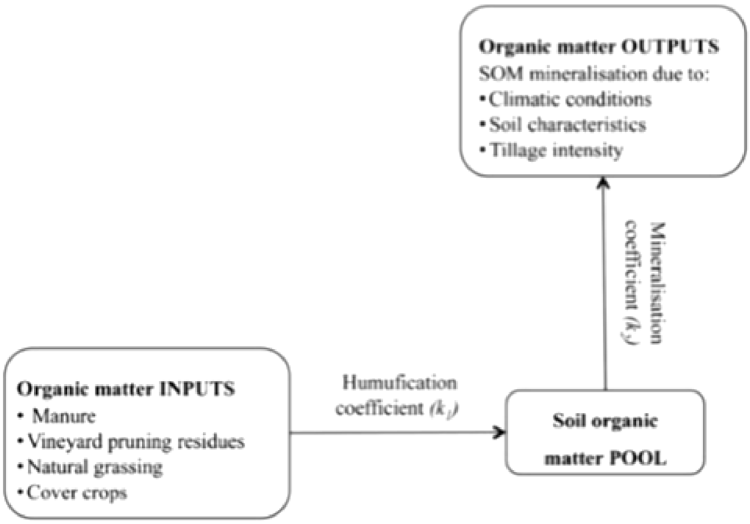


**Figure 4: Elements included in the model**

The carbon stock changes are based on the first-order kinetics model (Hénin and Depuis ,1945), to evaluate the effect of agricultural practices on the changes in a given pool by using the following formulae (Bosco et al., 2013):

**Equation 1. Method proposed for the estimation of the effect of agriculture practices on the changes in a given pool (process-based approach).**

$$SOM_t = SOM_0 * e^{-k_2 t} + k_1 * OM_I \Big/ k_2 \left(1 - e^{-k_2 t}\right)$$

Where:

| Parameter | Definition |
|---|---|
| $SOM_t$ | Soil Organic Matter at time t, expressed in Mg ha$^{-1}$. |
| $SOM_0$ | Soil Organic Matter at time $t_0$, expressed in Mg ha$^{-1}$. |
| $k_2$ | Mineralisation coefficient (corresponding to the annual rate of SOM loss by mineralisation). |
| $k_1$ | Humification coefficient (refers to the annual rate of organic matter inputs incorporated in SOM). |
| $OM_I$ | Annual organic matter inputs (i.e. fractions of organic matter originating from grapevine and cork oak trees (leaves and pruning residues), natural grass cover (above-ground and below-ground biomass), cover crops (above-ground and below-ground biomass) and manure, expressed in Mg ha$^{-1}$. |

The first component of Eq. 1 represents the fraction of $SOM_o$ still in the soil at time *t* when the vineyard was planted. In case this primary data is not available, the oldest SOM value for the soil assessed may be used as a proxy. The second component is the fraction of the SOM pool deriving from the humification of the organic material inputs since *t=0*.

The humification coefficient ($k_1$) default values of the organic matter input ($OM_I$) are included below (Fregoni, 1989; Boiffin et al., 1986) and could be used in the lack of site-specific values.

**Table 31. Humification coefficient (k1) default values of the organic matter input (OMI).**

| **Input** | **k1 values** | |
|---|---|---|
| Grapevines | Leaves | 0.1 |
| | Stalks | 0.2 |
| Pruning residues | | 0.3 |
| Inter-row grassing | Above-ground biomass | 0.2 |
| | Below-ground biomass | 0.2 |
| Manure | | 0.3 |

The mineralisation coefficient ($k_2$) is affected by air temperature, soil texture and limestone content. $k_2$ is calculated by using the following formulae (Boiffin et al., 1986; Bockstaller and Girardin, 2003):

**Equation 2. Method proposed for the estimation of the mineralisation coefficient ($k_2$).**

$$k_2 = 1{,}200 * \delta[(\mathrm{c} + 200)(l + 200)]$$

Where:

| Parameter | Definition |
|---|---|
| $\delta$ | Temperature factor, expressed in ºC. |
| c | Clay content, expressed in g $Kg^{-1}$. |
| l | Limestone content, expressed in g $Kg^{-1}$. |

**Equation 3. Method proposed for the estimation of temperature factor.**

$$\delta = 0.2 * (T - 5)$$

| Parameter | Definition |
|---|---|
| $\delta$ | Temperature factor, expressed in ºC. |
| T | Annual air temperature, expressed in ºC. |

**Conversion of Soil Organic Matter (SOM) to Soil Organic Carbon (SOC):**

Most analytical methods used routinely for measuring SOM contents actually determine the content of SOC, and not SOM. Since no single conversion factor is appropriate for all soils, it would be better to determine and report results from such determinations in term of SOC and not SOM value. In any case, SOC can be estimated from SOM values as follows:

**Equation 4. Method proposed for the estimation of Soil Organic Carbon (SOC).**

$$SOC = \frac{SOM}{CF}$$

Where:

| Parameter | Definition |
|---|---|
| SOC | Soil Organic Carbon, expressed in grams of C per 100 grams soil. |
| SOM | Soil Organic Matter; expressed in grams of organic matter per 100 grams soil. |
| CF | Conversion factor used ranged from 1.72 to 2.0 (default value: 1.86) |

The **stock-based approach** estimates the difference in carbon stocks at two points in time. The carbon stock changes in a given pool as an annual average difference between estimates at two points in time by using the stock-difference method can be estimated as follows:

**Equation 5. Method proposed for the estimation of annual carbon stock changes in a given pool (stock-based approach).**

$$C_{SOCi,t_2-t_1} = \frac{C_{SOCsp,i,t_2} - C_{SOCsp,i,t_1}}{t_2 - t_1} * \frac{44}{12}$$

Where:

| Parameter | Definition |
|---|---|
| $C_{SOCi,t2-t1}$ | Annual carbon stock change in the pool for stratum i, expressed in tonnes $CO_2$-e $ha^{-1}$ $yr^{-1}$. |
| $C_{SOCsp,i,t2}$ | Carbon stock in the pool for sample plot sp, stratum i, at time $t_2$; expressed in tonnes C $ha^{-1}$. |
| $C_{SOCsp,i,t1}$ | Carbon stock in the pool for sample plot sp, stratum i, at time $t_1$; expressed in tonnes C $ha^{-1}$. |
| 44/12 | Ratio of molecular weight of $CO_2$ to carbon, expressed in tonnes $CO_2$-e tonnes $C^{-1}$ |

**Equation 6. Method proposed for the estimation of carbon stock in the pool at time $t_2$.**

$$C_{SOCsp,i,t2} = \sum_{Sp=1}^{Pi} \frac{C_{SOCsample,sp,i,t2} * BD_{sample,sp,i,t2} * Dep_{sample,sp,i,t2}}{P_i}$$

Where:

| Parameter | Definition |
|---|---|
| $C_{SOCsp,i,t2}$ | Carbon stock in the pool for sample plot sp, stratum i, at time $t_2$; expressed in tonnes of C $ha^{-1}$. |
| $C_{SOCsample,sp,i,t2}$ | Soil organic carbon of the sample in sample plot sp, stratum i, at time $t_2$, determined in the laboratory in grams C/100 grams soil (fine fraction <2 mm). |
| $BD_{sample,sp,i,t2}$ | Bulk density of fine (<2 mm) fraction of mineral soil in sample plot sp, stratum i, at time $t_2$, determined in the laboratory in grams fine fraction per $cm^{-3}$ total sample volume. |
| $Dep_{sample,sp,i,t2}$ | Depth to which soil sample is collected in sample plot sp and stratum i at time $t_2$; expressed in cm. |
| Sp | Sample plots in stratum (Sp=1, 2, 3,..., Pi). |
| i | Strata (i=1, 2, 3,..., M) |
| $t_2$ | Last year of inventory time period at what soil sample is collected in sample plot sp and stratum i. |

**Equation 7. Method proposed for the estimation of carbon stock in the pool at time $t_1$.**

$$C_{SOCsp,i,t1} = \sum_{Sp=1}^{Pi} \frac{C_{SOCsample,sp,i,t1} * BD_{sample,sp,i,t1} * Dep_{sample,sp,i,t1}}{P_i}$$

Where:

| Parameter | Definition |
|---|---|
| $C_{SOCsp,i,t1}$ | Carbon stock in the pool for sample plot sp, stratum i, at time $t_1$; expressed in tonnes of C $ha^{-1}$. |
| $C_{SOCsample,sp,i,t1}$ | Soil organic carbon of the sample in sample plot sp, stratum i, at time $t_1$, determined in the laboratory in grams of C/100 grams soil (fine fraction <2 mm). |
| $BD_{sample,sp,i,t1}$ | Bulk density of fine (<2 mm) fraction of mineral soil in sample plot sp, stratum i, at time $t_1$, determined in the laboratory in grams fine fraction per $cm^{-3}$ total sample |
| $Dep_{sample,sp,i,t1}$ | Depth to which soil sample is collected in sample plot sp and stratum i at time $t_1$; expressed in cm. |
| Sp | Sample plots in stratum (Sp=1, 2, 3,…, Pi). |
| i | Strata (i=1, 2, 3,…, M) |
| $t_1$ | Year at beginning of inventory time period at what soil sample is collected in sample plot sp in stratum i. |

Notes:

- When using the stock-difference method, it is important to ensure that the area of land (sample plots) at times $t_1$ and $t_2$ are identical.
- It is good practice to use the area at the end of the inventory period ($t_2$) to define the area of land remaining in the land-use category. Under default assumptions therefore land will be transferred from a conversion category to a remaining category after it has been in a given land use for 20 years.

**Bulk density:**

For bulk density determination, samples (cores) of known volume are collected in the field and oven dried to a constant weight at 105 ºC (for a minimum of 48 hours). The total sample is then weighed, then any coarse rocky fragments (>2 mm) are sieved and weighed separately. The bulk density of the soil core is estimated as:

**Equation 8. Method proposed for the estimation of bulk density.**

$$BD_{sample} = \frac{ODW - RF}{CV}$$

Where:

| Parameter | Definition |
|---|---|
| $BD_{sample}$ | Bulk density of the < 2mm fraction, expressed in grams per cubic centimetre. |
| ODW | Oven dry mass total simple; expressed in grams. |
| RF | Mass of coarse fragments (> 2 mm); expressed in grams. |
| CV | Core volume; expressed in $cm^3$ |

## 14.2. Biogenic carbon stored in permanent plants structures

Biogenic carbon that vines and/or cork oak remain accumulating after the 100 year assessment period shall be calculated. A process-based approach in which the biomass carbon loss is subtracted from the biomass carbon gain (gain-loss method) is adopted to estimate the biogenic carbon balance in vine and cork oak biomass (aboveground and belowground) as follows:

**Equation 9. Method proposed for the estimation of the biogenic carbon balance in vine and cork oak biomass (aboveground and belowground).**

$$C_{B,t_1-t_0} = \left(PC_{i,t_1-t_0} * CF_i + PBTP_{j,t_1-t_0} * CF_j + PBS_{j,t_1} * CF_j - LBTP_{j,t_1-t_0} * CF_j\right)\frac{44}{12} * \frac{1}{N}$$

Where:

| Parameter | Definition |
|---|---|
| $C_{Bi,t1-t0}$ | Annual carbon balance in the pool of aboveground and belowground biomass, expressed in tonnes $CO_2$-e $ha^{-1}y^{-1}$ |
| $PC_{i,t1-t0}$ | Production (growth) of wood type i from time $t_0$ up to time $t_1$, expressed in tonne dry matter $ha^{-1}$. |
| $CF_i$ | Carbon fraction of dry matter of wood type i, expressed in tonne C (tonne dry matter)$^{-1}$. |
| $PBTP_{j,t1-t0}$ | Production (growth) of biomass component j from thinnings and prunings from time $t_0$ up to time $t_1$, expressed in tonne dry matter $ha^{-1}$. |
| $CF_j$ | Carbon fraction of dry matter of biomass component j, expressed in tonne C (tonne dry matter)$^{-1}$. |
| $PBS_{j,t1}$ | Production (growth) of biomass component j in standing trees at time $t_1$, expressed in tonne dry matter $ha^{-1}$. |
| $LBTP_{j,t1-t0}$ | Loss of biomass component j from thinnings and prunings that is oxidized (by burning or decay) from time $t_0$ up to time $t_1$, expressed in tonne dry matter $ha^{-1}$. |
| $t_0$ | Year of stand establishment |
| $t_1$ | Year 100 or beyond (proof shall be provided that the plantation is standing for this period already) |
| i | Wood types (e.g. =virgin cork, secondary cork, reproduction cork, "falca") |
| j | Biomass components (j=stem, branches, foliage, roots) |
| 44/12 | Ratio of molecular weight of $CO_2$ to carbon, expressed in tonnes $CO_2$-e tonnes $C^{-1}$ |
| N | Number of years comprised between $t_0$ and $t_1$ |

Note:

- For simplification, $PBTP_{j,t1-t0}$ can be considered equal to $LBTP_{j,t1-t0}$.

For the estimation of the $CO_2$ equivalent per functional unit, the following procedures should be applied:

For **vineyards**:

The following formula applies both for carbon permanently stored at soil and plant structures.

**Equation 10. Method proposed for the estimation of the carbon permanently stored at soil or plant structures of vineyards per functional unit.**

$$C_{V,FU} = \frac{C_V * Pe * Af_V}{Y_G}$$

Where:

| Parameter | Definition |
|---|---|
| $C_{V,FU}$ | Carbon permanently stored at soil or plant structures of vineyards per functional unit, expressed in tonnes $CO_2$-e per functional unit. |
| $C_V$ | Annual carbon stock change in the pool for stratum i ($C_{SOCi,t2-t1}$) or annual carbon balance in the pool of aboveground and belowground biomass ($C_{B,t1-t0}$) for vineyards, expressed in tonnes $CO_2$-e $ha^{-1}$ $yr^{-1}$. |
| $P_e$ | Plot extension, expressed in ha. |
| $Af_V$ | Allocation factor, expressed in kilograms of grapes needed per functional unit. |
| $Y_G$ | Yield of grapes, expressed in kilograms of grapes $yr^{-1}$. |

For **cork oak forests**:

The following formula applies both for carbon permanently stored at soil and plant structures.

**Equation 11. Method proposed for the estimation of the carbon permanently stored at soil or plant structures of cork oak forests per functional unit**

$$C_{C,FU} = \frac{C_C * Af_C}{Y_C * 10^6}$$

Where:

| Parameter | Definition |
|---|---|
| $C_{C,FU}$ | Carbon permanently stored at soil or plant structures of cork oak forests per functional unit, expressed in tonnes $CO_2$-e per functional unit. |
| $C_C$ | Annual carbon stock change in the pool for stratum i ($C_{SOCi,t2-t1}$) or annual carbon balance in the pool of aboveground and belowground biomass ($C_{B,t1-t0}$) for cork oak forests, expressed in tonnes $CO_2$-e $ha^{-1}$ $yr^{-1}$. |
| $Af_C$ | Allocation factor, expressed in grams of cork per functional unit. |
| $Y_C$ | Average yield of cork over the period analysed, expressed in tonnes of cork $ha^{-1}$ $yr^{-1}$, |

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# 16 ANNEX 7 – Packaging reuse rates

Reuse rate is the number of times a packaging material is used (e.g., filled) at the factory. This is often also called trip rates, reuse time or number of rotations. This may be expressed as the absolute number of reuse or as % of reuse rate. For example: a reuse rate of 80% equals 5 reuses. Equation 12 describes the conversion:

**Equation 12. Calculation of number of reuse**

$$\text{Number of reuse} = \frac{1}{100\% - \%\, reuse\ rate}$$

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

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

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

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

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

$$\text{Reuse rate of the bottle pool} = \frac{\#\,F_i}{\#B} \qquad \textbf{[Equation 13]}$$

$$\text{The net glass use (kg glass/l beverage)} = \frac{\#B \times (kg\ glass/bottle)}{\#F_i} \qquad \textbf{[Equation 14]}$$

This calculation option shall be used:

i. With data of the previous bottle pool when the previous and current bottle pool are comparable. Meaning, the same product category, similar bottle characteristics (e.g., size), comparable return systems (e.g., way of collection, same consumer group and outlet channels), etc.

ii. With data of the current bottle pool when future estimations/extrapolations are available on (i) the bottle purchases, (ii) the volumes sold, and (iii) the lifetime of the bottle pool.

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

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

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

$$\text{Reuse rate of the bottle pool} = \frac{LT}{(LT \times \%Los) + \left(\frac{1}{\#Rot}\right)} \qquad \text{[Equation 15]}$$

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