# PRODUCT ENVIRONMENTAL FOOTPRINT CATEGORY RULES (PEFCR)
# APPAREL AND FOOTWEAR

DISCLAIMER – PEFCR APPAREL AND FOOTWEAR

This publication is a report by the Technical Secretariat of the Product Environmental Footprint Category Rules (PEFCR) for Apparel and Footwear. It is a voluntary tool and aims to be used by the industry internally to identify the environmental hotspots and to help in the reduction of the environmental impacts of a garment or footwear. It can be also used to support any factual communication related to at least the four most relevant impact categories or additional environmental information of a product. The PEFCR for apparel and footwear does not allow the use of the single score for business to consumer communications, nor its use for comparison against the representative products.

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# APPAREL AND FOOTWEAR

Version 3.1

29 April 2025

Valid to: 31st December 2027

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**Voting members**: Alliance for European Flax-Linen & Hemp, C&A, Cascale, Cotton Incorporated, Décathlon, Fédération de la Haute Couture et de la Mode (FHCM), H&M, Inditex, Lacoste, Nike, Refashion, Sympatex, VF Corporation and W.L. Gore & Associates

**Non-voting members:** ADEME (Agence de la Transition Ecologique), CEC (European Footwear Confederation), CNMI (Camera Nazionale della Moda Italiana), ECOS (Environmental Coalition on Standards), EURATEX (The European Apparel and Textile Confederation), FESI (Federation of the European Sporting Goods Industry), the International Fur Federation, and IWTO (International Wool Textile Organisation),

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*This PEFCR has partly been financially supported by the EU LIFE Grant (Project-ID PRE/FR/000013).*

Co-funded by the European Union

| THIRD PEFCR INFORMATION | |
|---|---|
| Title | Product Environmental Footprint Category Rules: Apparel and Footwear |
| Leading organization | Cascale (former Sustainable Apparel Coalition) |
| Liability statement | Information contained in this report has been compiled and/or computed from sources believed to be credible. Application of the data are strictly at the discretion and the responsibility of the reader. Quantis is not liable for any loss or damage arising from the use of the information in this document. |
| Validity | Geographic validity: EU-27, UK, EFTA<br>These category rules are in full compliance with the PEF method (2021). |
| Version | Version 3.1 – Final PEFCR, 29th April 2025 |
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| Associated files | A&F_PEFCR Annex II – PEF study template<br>A&F_PEFCR Annex V – Detailed requirements regarding intrinsic durability<br>A&F_PEFCR Annex VII - Inventory modelling and default datasets<br>A&F_PEFCR Annex XI – Calibration sheet for the pre-verification of the IDM calculation module in tools |


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## How to read this document

**Notes addressed to the reader** are presented in orange boxes, as shown below:

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| Note | This document is based on the template provided in Annex II part B: PEFCR Template of the PEF method (2021) which shall be applied for all types of PEFCR. |

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# Acronyms and abbreviations

| | |
|---|---|
| µm | Micrometre |
| AWARE | Available WAter REmaining |
| BOM | Bill Of Materials |
| BSI | British Standards Institution |
| CEC | European Footwear Confederation |
| CFCs | Chlorofluorocarbons |
| CELC | European Confederation of Flax and Hemp |
| CFs | Characterization Factors |
| CFF | Circular Footprint Formula |
| CNMI | Camera Nazionale della Moda Italiana |
| CMWG | Cattle Model Working Group |
| $CO_2$ | Carbon Dioxide |
| CPA | Classification of Products by Activity |
| CTUe | Comparative Toxic Units for ecosystems |
| CTUh | Comparative Toxic Units for human health |
| DC | Distribution Centre |
| DNM | Data Needs Matrix |
| DoS | Duration of Service |
| DQR | Data Quality Rating |
| EC/DG-ENV | European Commission/Directorate-General for the Environment |
| ECOS | Environmental Coalition on Standards |
| EEB | European Environmental Bureau |
| EF | Environmental Footprint |
| EFTA | European Free Trade Association |
| EVA | Ethylene Vinyl Acetate |
| ELCD | European Reference Life Cycle Database |
| EOL | End Of Life |
| FAO | Food and Agriculture Organization of the United Nations |
| FESI | Federation of the European Sporting Goods Industry |
| FHCM | Fédération de la Haute Couture et de la Mode |
| F2C | Factory to Consumer |
| FU | Functional Unit |
| g | gram |
| GHGs | Greenhouse gases |
| GeR | Geographical Representativeness |
| $GeR_{SD}$ | Geographical Representativeness evaluated at the level of the secondary dataset |
| Higg PM | Higg Product Module |
| IFF | International Fur Federation |
| ILCD | International reference Life Cycle Data system |
| IPCC | Intergovernmental Panel on Climate Change |
| ISO | International Organization for Standardization |
| IWTO | International Wool Textile Organisation |
| JRC | Joint Research Centre |
| kBq $U^{235}$ eq | kilobecquerel uranium-235 equivalent |
| kcal | kilocalorie |
| kg | kilogram |
| kg CFC-11 eq | kilogram of trichlorofluoromethane or freon-11 equivalent |
| kg $CO_2$-eq | kilogram of carbon dioxide equivalent |

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| kg N eq | kilogram of nitrogen equivalent |
| kg NMVOC eq | kilogram of non-methane volatile organic compounds equivalent |
| kg P eq | kilogram of phosphorus equivalent |
| kg Sb eq | kilogram of antimony equivalent |
| km | kilometre |
| kWh | kilowatt-hour |
| LCA | Life Cycle Assessment |
| LCI | Life Cycle Inventory |
| LCIA | Life Cycle Inventory Assessment |
| LCS | Life Cycle Stage |
| LHVs | Lower Heating Values |
| LUC | Land Use Change |
| m | metre |
| $m^2$ | metre squared |
| $m^3$ | cubic metre |
| ME | Metabolizable Energy |
| MJ | *Megajoule* |
| mol $H^+$ | mole of Hydrogen ion |
| mol N eq | mole of Nitrogen equivalent |
| NACE | Nomenclature Générale des Activités Economiques dans les Communautés Européennes |
| NOx | Nitrogen Oxides |
| ODP | Ozone Depletion Potential |
| P | Precision/uncertainty |
| $P_{AD}$ | Precision evaluated at the level of the Activity Data |
| PAF | Potentially Affected Fraction of Species |
| PDF | Potentially Disappeared Fraction of Species |
| PE | Polyethylene |
| PEF | Product Environmental Footprint |
| PEFCR | Product Environmental Footprint Category Rules |
| PET | Polyethylene Terephthalate |
| PM | Particulate Matter |
| PPP | Purchasing Power Parity |
| Pt | Point for dimensionless values |
| PTFE | Polytetrafluoroethylene |
| RC | Repair Cost |
| RRC | “Right to Repair” Communication |
| RP | Representative Product |
| RS | Repair Services |
| SFIP | Semi-finished and intermediate products |
| SME | Small and Medium-sized Enterprise |
| SMGP | Single Market for Green Products |
| SP | Spare Parts |
| t | tonne |
| TAB | Technical Advisory Board |
| TeR | Technological Representativeness |
| $TeR_{SD}$ | Technological Representativeness evaluated at the level of the secondary dataset |
| TiR | Time Representativeness |
| $TiR_{AD}$ | Time Representativeness evaluated at the level of the activity data |
| $TiR_{SD}$ | Time Representativeness evaluated at the level of the secondary dataset |
| tkm | tonne kilometre |

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| TS | Technical Secretariat |
| UUID | Universally Unique Identifier |
| VOCs | Volatile Organic Compounds |

# Definitions

This glossary defines key terms used in this document.

### Life Cycle Assessment definitions

Definitions with an asterisk (*) come from the European Commission recommendation C(2021) 9332 final, on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations and is herein referred to as the PEF method. For further clarifications, please refer to the PEF method[1].

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| A factor of the CFF | Allocation factor of burdens and credits between supplier and user of recycled materials. |
| Activity data* | Information which is associated with processes while modelling Life Cycle Inventories (LCI). The aggregated LCI results of the process chains, which represent the activities of a process, are each multiplied by the corresponding activity data and then combined to derive the environmental footprint associated with that process. 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. Synonym of “non-elementary flow”. |
| Acidification* | EF impact category that addresses impacts due to acidifying substances in the environment. Emissions of $NO_x$, $NH_3$ and $SO_x$ lead to releases of hydrogen ions ($H^+$) when the gases are mineralised. The protons contribute to the acidification of soils and water when they are released in areas where the buffering capacity is low, resulting in forest decline and lake acidification. |
| Additional environmental information* | Environmental information outside the EF impact categories that is calculated and communicated alongside PEF results. |
| Aggregated dataset* | Complete or partial life cycle of a product system that - next to the elementary flows (and possibly not relevant amounts of waste flows and radioactive wastes) - itemises only the product(s) of the process as reference flow(s) in the input/output list, but no other goods or services. Aggregated datasets are also called "LCI results” datasets. The aggregated dataset may have been aggregated horizontally and/or vertically. |
| Allocation* | An approach to solving multi-functionality problems. It refers to “partitioning the input or output flows of a process or a product system between the product system under study and one or more other product systems”. |
| Application specific* | Generic aspect of the specific application in which a material is used. For example, the average recycling rate of PET in bottles. |
| B factor of the CFF | Allocation factor of energy recovery processes: it applies both to burdens and credits. |
| Background processes* | Refers to those processes in the product life cycle for which no direct access to information is possible. For example, most of the upstream life-cycle processes and generally all processes further downstream will be considered part of the background processes. |

[1] https://environment.ec.europa.eu/document/download/680503dc-5a19-4f6a-bb92-84d9bfc8f312_en?filename=Annexes%201%20to%202.pdf

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| Benchmark* | A standard or point of reference against which any comparison may 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. |
| CFF | Circular Footprint Formula. The CFF is an approach developed in the frame of the PEF to account for and allocate the impacts and benefits of the end-of-life of materials between different systems (the waste producer and the user of recycled or recovered products) |
| Characterisation* | Calculation of the magnitude of the contribution of each classified input/output to their respective EF impact categories, and aggregation of contributions within each category. This requires a linear multiplication of the inventory data with characterisation factors for each substance and EF impact category of concern. For example, with respect to the EF impact category "climate change", the reference substance is $CO_2$ and the reference unit is kg $CO_2$-equivalents. |
| Characterisation factor* | Factor derived from a characterisation model which is applied to convert an assigned life cycle inventory result to the common unit of the EF impact category indicator. |
| Climate change* | EF impact category considering all inputs or outputs that result in greenhouse gas (GHG) emissions. The consequences include increased average global temperatures and sudden regional climatic changes. |
| Company-specific data* | Refers to directly measured or collected data from one or multiple facilities (site-specific data) that are representative for the activities of the company (company is used as synonym for organisation). It is synonymous to "primary data". To determine the level of representativeness, a sampling procedure may be applied. |
| Company-specific dataset* | Refers to a dataset (disaggregated or aggregated) compiled with company-specific data. In most cases the activity data is company-specific while the underlying sub-processes are datasets derived from background databases. |
| Comparative assertion* | An environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function (including the benchmark of the product category). |
| 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 PEFCR. |
| Consumer* | An individual member of the general public purchasing or using goods, property or services for private purposes. |
| Cradle to grave * | A product's life cycle that includes raw material extraction, processing, distribution, storage, use, and disposal or recycling stages. All relevant inputs and outputs are considered for all of the stages of the life cycle. |
| Critical review* | Process intended to ensure consistency between a PEFCR and the principles and requirements of the PEF method. |
| Cut-off* | Any cut-off shall be avoided, unless under the following rules:<br><br>Processes and elementary flows may be excluded up to 3.0%, based on material and energy flows and the level of environmental significance (single overall score). The processes subject to cut-off shall be made explicit and justified in the PEF report, in particular with reference to the environmental significance of the cut-off applied.<br><br>This cut-off has to be considered additionally to the cut-off already included in the background datasets. This rule is valid for both intermediate and final products. |

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| | The processes that in total account less than 3.0% of the material and energy flow and environmental impact for each impact category may be excluded from PEF studies (starting from the less relevant).<br><br>A screening study is recommended to identify processes that may be subject to cut-off. |
| Data Quality Rating* | 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. |
| Disaggregation* | The process that breaks down an aggregated dataset into smaller unit process datasets (horizontal or vertical). The disaggregation may help making data more specific. The process of disaggregation should never compromise or threaten to compromise the quality and consistency of the original aggregated dataset. |
| Downstream* | Occurring along a product supply chain after the point of referral. |
| Ecotoxicity, freshwater* | Environmental footprint impact category that addresses the toxic impacts on an ecosystem, which damage individual species and change the structure and function of the ecosystem. Ecotoxicity is a result of a variety of different toxicological mechanisms caused by the release of substances with a direct effect on the health of the ecosystem. |
| ED factor of the CFF | specific emissions and resources consumed (per unit of analysis) arising from disposal of waste material at the EoL of the analysed product, without energy recovery. |
| EER factor of the CFF | Specific emissions and resources consumed (per unit of analysis) arising from the energy recovery process (e.g. incineration with energy recovery, landfill with energy recovery, …). |
| EF compliant dataset* | Dataset developed in compliance with the EF requirements, regularly updated by DG JRC[2]. |
| Electricity tracking* | The process of assigning electricity generation attributes to electricity consumption[3]. |
| Elementary flows* | In the life cycle inventory, elementary flows include “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”. Elementary flows include, for example, resources taken from nature or emissions into air, water, soil that are directly linked to the characterisation factors of the EF impact categories. |
| $E_{recycled}$ ($E_{rec}$) factor of the CFF formula | Specific emissions and resources consumed (per unit of analysis) arising from the recycling process of the recycled (reused) material, including collection, sorting and transportation process. |
| $E_{recyclingEoL}$ ($E_{recEoL}$) factor of the CFF | Specific emissions and resources consumed (per unit of analysis) arising from the recycling process at EoL, including collection, sorting and transportation process. |
| $E_{SE,heat}$ and $E_{SE,elec}$ factor of the CFF | Specific emissions and resources consumed (per unit of analysis) that would have arisen from the specific substituted energy source, heat and electricity respectively. |

[2] https://eplca.jrc.ec.europa.eu/permalink/Guide_EF_DATA.pdf
[3] https://ec.europa.eu/energy/intelligent/projects/en/projects/e-track-ii

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| Eutrophication* | EF impact category related to nutrients (mainly nitrogen and phosphorus) from sewage outfalls and fertilised farmland that accelerate the growth of algae and other vegetation in water. The degradation of organic material consumes oxygen, resulting in oxygen deficiency and, in some cases, fish death. Eutrophication translates the quantity of substances emitted into a common measure expressed as the oxygen required for the degradation of dead biomass. To assess the impacts due to eutrophication, three EF impact categories are used: Eutrophication, terrestrial; Eutrophication, freshwater; Eutrophication, marine. |
| $E_v$ factor of the CFF | Specific emissions and resources consumed (per unit of analysis) arising from the acquisition and pre-processing of virgin material. |
| $E^*_v$ factor of the CFF | Specific emissions and resources consumed (per unit of analysis) arising from the acquisition and pre-processing of virgin material assumed to be substituted by recyclable materials. |
| Foreground processes* | Those processes in the product life cycle for which direct access to information is available. For example, the producer's site and other processes operated by the producer or its contractors (e.g. goods transport, head-office services, etc.). |
| Functional unit* | Defines the qualitative and quantitative aspects of the function(s) and/or service(s) provided by the product being evaluated. The functional unit definition answers the questions "what?", "how much?", "how well?", and "for how long?". |
| Global warming potential* | An index measuring the radiative forcing of a unit mass of a given substance accumulated over a chosen time horizon.It is expressed in terms of a reference substance (for example, $CO_2$-equivalent units) and specified time horizon (e.g. GWP 20, GWP 100, GWP 500 - for 20, 100, and 500 years respectively). By combining information on both radiative forcing (the energy flux caused by emission of the substance) and on the time it remains in the atmosphere, GWP gives a measure of a substance's capacity to influence the global average surface-air temperature and therefore subsequently influence various climate parameters and their effects, such as storm frequency and intensity, rainfall intensity and frequency of flooding, etc |
| Human toxicity – cancer* | EF impact category that accounts for adverse health effects on human beings caused by the intake of toxic substances through inhalation of air, food/water ingestion, penetration through the skin insofar as they are related to cancer. |
| Human toxicity – non cancer* | EF impact category that accounts for the adverse health effects on human beings caused by the intake of toxic substances through inhalation of air, food/water ingestion, penetration through the skin insofar as they are related to non-cancer effects that are not caused by particulate matter/respiratory inorganics or ionising radiation. |
| Input flows* | Product, material or energy flow that enters a unit process. Products and materials include raw materials, intermediate products and co-products. |
| Ionising radiations, human health* | EF impact category that accounts for the adverse health effects on human health caused by radioactive releases. |
| Land use* | EF impact category related to use (occupation) and conversion (transformation) of land area by activities such as agriculture, forestry, roads, housing, mining, etc. Land occupation considers the effects of the land use, the amount of area involved and the duration of its occupation (changes in soil quality multiplied by area and duration). Land transformation considers the extent of changes in land properties and the area affected (changes in soil quality multiplied by the area). |
| Life cycle* | Consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal. |

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| Life cycle approach* | Takes into consideration the spectrum of resource flows and environmental interventions associated with a product from a supply-chain perspective, including all stages from raw material acquisition through processing, distribution, use, and end of life processes, and all relevant related environmental impacts (instead of focusing on a single issue). |
| Life cycle assessment* | Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle. |
| Life cycle inventory* | The combined set of exchanges of elementary, waste and product flows in a LCI dataset. |
| Life cycle inventory 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. |
| LHV | Lower Heating Value of the material in the product that is used for energy recovery. |
| Normalisation* | After the characterisation step, normalisation is the step in which the life cycle impact assessment results are multiplied by normalisation factors that represent the overall inventory of a reference unit (e.g. a whole country or an average citizen). Normalised life cycle impact assessment results express the relative shares of the impacts of the analysed system in terms of the total contributions to each impact category per reference unit. When displaying the normalised life cycle impact assessment results of the different impact topics next to each other, it becomes evident which impact categories are affected most and least by the analysed system. Normalised life cycle impact assessment results reflect only the contribution of the analysed system to the total impact potential, not the severity/relevance of the respective total impact. Normalised results are dimensionless, but not additive. |
| Output flows* | Product, material or energy flow that leaves a unit process. Products and materials include raw materials, intermediate products, co-products and releases. Output flows are also considered to cover elementary flows. |
| Ozone depletion* | EF impact category that accounts for the degradation of stratospheric ozone due to emissions of ozone-depleting substances, for example long-lived chlorine and bromine containing gases (e.g. chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), Halons). |
| Partially disaggregated dataset* | A dataset with a LCI that contains elementary flows and activity data, and that yields a complete aggregated LCI data set when combined with its complementing underlying datasets. |
| Partially disaggregated dataset at level-1* | A partially disaggregated dataset at level-1 contains elementary flows and activity data for one level down in the supply chain, while all complementing underlying datasets are in their aggregated form. |
| Particulate matter* | EF impact category that accounts for the adverse health effects on human health caused by emissions of Particulate Matter (PM) and its precursors ($NO_x$, $SO_x$, $NH_3$). |
| 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 report. |
| PEF study* | Term used to identify the totality of actions needed to calculate the PEF results. It includes the modelling, the data collection, and the analysis of the results. PEF study results are the basis for drafting PEF reports. |
| Photochemical ozone formation* | EF impact category that accounts for the formation of ozone at the ground level of the troposphere caused by photochemical oxidation of volatile organic compounds (VOCs) and carbon monoxide (CO) in the presence of nitrogen |

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| | oxides ($NO_x$) and sunlight. High concentrations of ground-level tropospheric ozone damage vegetation, human respiratory tracts and manmade materials through reaction with organic materials. |
| Primary data or site-specific data* | Data from specific processes within the supply chain of the user of the PEF method or user of the PEFCR. Such data may take the form of activity data, or foreground elementary flows (life cycle inventory). Primary data are site-specific, company-specific (if multiple sites for the same product) or supply chain specific. Primary data may be obtained through meter readings, purchase records, utility bills, engineering models, direct monitoring, material/product balances, stoichiometry, or other methods for obtaining data from specific processes in the value chain of the user of the PEF method or user of the PEFCR. In this method, primary data is a synonym of "company-specific data" or "supply-chain specific data". |
| Purchasing Power Parity (PPP) | Purchasing Power Parities (PPPs) are the rates of currency conversion that equalize the purchasing power of different currencies by eliminating the differences in price levels between countries. In their simplest form, PPPs are simply price relatives that show the ratio of the prices in national currencies of the same good or service in different countries. PPPs are also calculated for product groups and for each of the various levels of aggregation up to and including Gross Domestic Product (source: OECD). |
| $Q_p$ factor of the CFF | Quality of the primary material, i.e. quality of the virgin material. |
| $Qs_{in}$ factor of the CFF | Quality of the ingoing secondary material, i.e. the quality of the recycled material at the point of substitution. |
| $Qs_{out}$ factor of the CFF | Quality of the outgoing secondary material, i.e. the quality of the recyclable material at the point of substitution. |
| $R_1$ factor of the CFF | It is the proportion of material in the input to the production that has been recycled from a previous system. |
| $R_2$ factor of the CFF | 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. |
| $R_3$ factor of the CFF | It is the proportion of the material in the product that is used for energy recovery at EoL. |
| Reference flow* | Measure of the outputs from processes in a given product system required to fulfil the function expressed by the functional unit. |
| Renewable energy | Renewable energy is defined as the contribution of renewables to total primary energy supply (TPES). Renewables include the primary energy equivalent of hydro (excluding pumped storage), geothermal, solar, wind, tide and wave sources. Energy derived from solid biofuels, biogasoline, biodiesels, other liquid biofuels, biogases and the renewable fraction of municipal waste are also included. Biofuels are defined as fuels derived directly or indirectly from biomass (material obtained from living or recently living organisms). This includes wood, vegetal waste (including wood waste and crops used for energy production), ethanol, animal materials/wastes and sulphite lyes. Municipal waste comprises wastes produced by the residential, commercial and public service sectors that are collected by local authorities for disposal in a central location for the production of heat and/or power. This indicator is measured in thousand toe (tonne of oil equivalent) as well as in percentage of total primary energy supply. (OECD) |
| Representative product (model)* | The RP may be a real or a virtual (non-existing) product. The virtual product should be calculated based on average European market sales-weighted characteristics of all existing technologies/materials covered by the product category or sub-category. Other weighting sets may be used, if justified, for |

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| | example weighted average based on mass (ton of material) or weighted average based on product units (pieces). |
| Resource use, fossil* | EF impact category that addresses the use of non-renewable fossil natural resources (e.g. natural gas, coal, oil). |
| Resource use, minerals and metals* | EF impact category that addresses the use of non-renewable abiotic natural resources (minerals and metals). |
| Secondary data* | Data that is not from a specific process within the supply chain of the company performing a PEF study. This refers to data that is not directly collected, measured, or estimated by the company, but sourced from a third party LCI 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 may 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. |
| Sensitivity analysis* | Systematic procedures for estimating the effects of the choices made regarding methods and data on the results of a PEF study. |
| Small and Medium-sized Enterprise (SME) | An SME is defined as:<br>• Any company below the threshold for a medium-sized enterprise from the EU definition in EU recommendation 2003/361: Enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million;<br>• Unless a local legislation on transparency defines SMEs as enterprises having fewer employees or a lower turnover or a lower annual balance sheet, in which case, that definition shall be used instead. |
| Sub-processes* | Processes used to represent the activities of the level 1 processes (= building blocks). Sub-processes may be presented in their (partially) aggregated form. |
| System boundary* | Definition of aspects included or excluded from the study. For example, for a “cradle-to-grave” EF analysis, the system boundary includes all activities from the extraction of raw materials through the processing, distribution, storage, use, and disposal or recycling stages. |
| Transport leg | Transport between 2 steps of the supply chain |
| Unit process * | Smallest element considered in the LCI for which input and output data are quantified. |
| Upstream* | Occurring along the supply chain of purchased goods/ services prior to entering the system boundary. |
| Water use* | EF impact category that represents the relative available water remaining per area in a watershed, after demand of humans and aquatic ecosystems has been met. It assesses the potential of water deprivation, to either humans or ecosystems, based on the assumption that the less water remaining available per area, the more likely another user will be deprived. |
| Weighting* | A step that supports the interpretation and communication of the analysis results. PEF results are multiplied by a set of weighting factors (in %), which reflect the perceived relative importance of the impact categories considered. Weighted EF results may be directly compared across impact categories, and also summed across impact categories to obtain a single overall score. |
| $X_{ER,heat}$ and $X_{ER,elec}$ factor of the CFF | The efficiency of the energy recovery process for both heat and electricity. |

## Apparel and footwear definitions

Definitions come from:

- * “Clothing Technology, from fibre to fashion” (Eberle, 2004)
- ¤ “How Shoes are Made” (Motawi, 2018)

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| Bast fibre extraction (originally for flax)* | After pulling and roughing out the plant.<br>**Retting** degrades the woody part of the stems so that the fibres are loosened. The stalks are placed in tanks of warm water where they lay for 5 to 8 days. This is followed by drying<br>Breaking and **Scutching**: after loosening the fibres from the wood by retting, the straw is broken and the woody parts are removed by scutching. The products are line fibre, with a length of 45 to 90 cm, and scutcher tow, with a length of 10 to 25 cm. |
| Bill of Materials (BOM) | The Bill of Materials (BOM) is the list and amounts of finished materials and components needed to manufacture and assemble a product. Raw materials, as well as their manufacturing details to convert them into finished materials and components, are included in this definition. This means that the BOM shall include more detailed information such as yarn type (size and construction method), textile formation (average yarn size and textile type - knit/woven/nonwoven) and finishing techniques (chemical finishes such as water repellency, stain release, etc as well as mechanical or heat treatments such as calendaring, brushing, shearing, etc). |
| Colour fastness* | Fastness of dyes and prints to rubbing, washing, cross staining, light, weather, seawater, ironing and dry-cleaning solvents. |
| Commodity | Commodities are vital components of commerce that are standardised and hence easy to exchange for goods of the same type, have a fairly uniform price around the world (excluding transport costs and taxes) and help make other products (The Economist, 2017) |
| Defective products | Defective products can be classified into two types:<br>• Defective products only once they have reached the brand’s distribution scheme (in the scope of unsold consumer products)<br>• Defective products in manufacturing, before reaching the brand’s distribution scheme (out of the scope of unsold consumer products) |
| Delasting | Delasting involves removing the shoe upper over a last (a foot-shaped tool). (Inspired from *, see Lasting) |
| Die cutting ¤ | Most shoe parts are made by die cutting. The cutting die looks just like a big cookie cutter but has a sharpened steel edge. Each shoe part will require its own cutting die. |
| Dimensional stability* | Dimensional changes (shrinking, stretching or twisting) during aftercare laundering and cleaning procedures. |
| Dyeing and finishing* | Includes all fabric processes that are not included in fibre production, yarn production, and fabric formation. Finishing effectively means to improve or to beautify the material, ready for sale. There are generally three basic objectives in finishing<br>● Modification of the surface (raising, smoothing, embossing etc)<br>● Modification of the wearing properties (staining, creasing, draping etc)<br>● Modification of aftercare characteristics (ironing, shrinking etc) |
| Exceptional pieces | “Exceptional pieces” are defined as apparel or footwear products, non-industrially produced or handicraft and/or unique custom made and/or with a designation of Intangible Cultural Heritage (or others like Haute Couture in France), to be worn on specific occasions such as artistic representations, |

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| | ceremonial or formal dress. These pieces can require the intervention of a skilled craftsperson, or "artisan d'art", such as embroiderer, feather worker, pleater, goldsmith, adornment maker, milliner, bootmaker, glovemaker etc. (interpretation from UNESCO Convention[4], definition "métiers de l'artisanat d'art"[5]). |
| Fibre fragment | A short piece of textile fibre, broken from the main textile construction or through its subsequent breakage in the natural environment<br>Source : TMC glossary |
| Fur | Hide or skin, exclusively of animal origin, different from that of bovine, sheep and goat, with its original fibrous structure more or less intact tanned to be rot-proof, which by its characteristic always retains hair or wool or both.<br>(Definition of the International Fur Federation (IFF)) |
| Genuine fur or genuine leather products | Apparel products or accessories containing at least 80% by weight of genuine fur and / or genuine leather. |
| Grading* | Grading means the stepwise increase or decrease of a master pattern piece to create larger or smaller sizes. The starting point can be the smallest size or the middle size. Grading alters the overall size of a design but not its general shape and appearance. Computer-aided grading systems utilise internal calculation algorithms (grading rules) for pattern construction. |
| Hangtag | A hangtag is a removable tag attached to a product which provides non-required information about the product and the brand (Inspired from Textile Labelling definition, U.S. Federal Trade Commission). |
| Higg Product Module (PM) | The Product Module is a sustainability assessment tool that considers a product's environmental impact from creating materials all the way to product end-of-life, developed by Cascale . |
| Inventory glut | Items that are made for a brand/retailer and sent to their distribution center, such as surplus, excessive inventory, overstock and deadstock. |
| Knitting* | Knitted fabrics are made from interlocking loops, formed from a single yarn or from many (ISO 7839:1984).<br><br>Circular knitting - The fabric is manufactured on circular machines as long lengths in the form of a tube. The fabric can be maintained in its tubular form throughout processing or, after the preparation and dyeing operations, it can be cut open for final finishing and garment making. |
| Lasting | Lasting involves stretching the shoe upper over a last (a foot-shaped tool) and securing it in place. (Inspired from *) |
| Leather | A general term for hide or skin, exclusively of animal origin, with its original fibrous structure more or less intact, tanned to be rot-proof. The hair or wool may or may not have been removed. Leather is also made from a hide or skin which has been split into layers or segmented either before or after tanning. If the leather has a surface coating, however applied, or a glued-on finish, such surface layers must not be thicker than 0,15 mm.<br>However, if the tanned hide or skin is disintegrated mechanically and/or chemically into fibrous particles, small pieces or powders and then, with or without the combination of a binding agent, is made into sheets or other forms, such sheets or forms are not leather.<br>(Definition of the International Council of Tanners (ICT)). |
| Manufacturing leftovers | Deadstock fabrics (or surplus fabrics, fabric rolls leftovers). Deadstock fabric is excess fabric inventory, including roll ends, that will not be directly cut and/or used in the production of products. |

[4] Text of the Convention for the Safeguarding of the Intangible Cultural Heritage, Article 2.
[5] Article 22, Loi n° 2014-626 du 18 juin 2014 relative à l'artisanat, au commerce et aux très petites entreprises; Arrêté du 24 décembre 2015 fixant la liste des métiers d'art, en application de l'article 20 de la loi n° 96-603 du 5 juillet 1996 relative au développement et à la promotion du commerce et de l'artisanat

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| | Note: This definition does not include 'cutting scraps', which are the leftover fabric scraps when making apparel and footwear products, and which represents the "assembly losses" of another product. |
| Microfibre | The textile industry definition of a microfibre is a synthetic fibre with a linear density of less than 1 denier. There is a different understanding of this term in the context of unintended release of fibres and thus subsequent microfibre pollution. The Microfibre Consortium, in this context does not determine the size nor the type. To avoid such confusion, fibre fragment / fibre fragmentation is the preferred terminology.<br><br>Source : TMC glossary |
| Microplastic | A small piece of plastic debris measuring 5mm or less, found in the environment from the disposal or breakdown of consumer products and industrial waste. Synthetic fibre fragments are considered microplastics.<br><br>Source : TMC glossary |
| Pattern* | A pattern is a diagrammatic representation of the way a garment part is constructed. This forms the working plan for its manufacture. |
| Pilling resistance* | Measurement of the number of pills that form during a defined period of surface rubbing. |
| Printing | Printing is the process of applying colour to fabric in definite patterns or designs. A placement print is a design that is placed in a specific location on a product, whereas all-over prints cover the whole fabric surface. |
| Product | For communication purposes, a product is defined by an individual and unique specific material composition, material construction, fabric weight or material density, dyeing method as well as fabric or material treatment and finishes. |
| Repairability | The capacity of a product to be repaired. This should not be confused with the “likelihood that the product will be repaired”. |
| Retting* | See bast fibre extraction. |
| Scouring* | Removal of natural or adventitious impurities, or processing aids (waxes, lubricants) applied during yarn and fabric formation. |
| Scutching | See bast fibre extraction. |
| Small series | Small series are defined as series produced globally under 1,000 units by product reference (model-material), and also not exceeding 500 product references (model-material) annually for the product sub-category for apparel and under 500 units by product reference (model-material) for footwear, by brand (i.e. all market categories, women and men), based on SMEs and creative fashion brands practices. |
| Sport segment | Product intended primarily for use in an organized or individual capacity related to physical activity and designed with functional elements specifically for the intended use and practiced activity. Product appearance shall not be the sole characteristic evaluated to determine inclusion in this segment. |
| Stockfitting ¤ | Stockfitting is an assembly operation that is done away from the main assembly. The separate outsole components are assembled on the stock fitting line before they are taken to the main assembly line. |
| Treatments (finishing)*<br>*Reworded for clarity* | Whereas mechanical (dry) finishing is concerned mainly with modifying the surface of the fabric, chemical (wet) finishing aims to effect a radical change in the basic fibre or fabric properties, in order to improve some aspect of its behaviour.<br>● Examples of dry finishes are framing, raising, embossing, sanding.<br>● Examples of wet finishes are water repellence, stain resistance, flame resistance, anti-pilling. |

| | |
|---|---|
| Trims | A non-integral, often decorative, component that is part of a product. Trims include sewing thread, buttons, zippers, labels, edging, and hook and loop fastener. Embellishments including embroidery, heat transfers, and graphics which cover less than 15% of the surface area of a product are also considered trims (Cascale). |
| Unsold Consumer Products | Any consumer product that has not been sold including surplus, excessive inventory, overstock and deadstock, including products returned by a consumer in view of their right of withdrawal in accordance with Article 9 of Directive (EU) 2011/83/EU, or, where applicable, during any longer withdrawal period provided by the trader (as defined in Ecodesign for Sustainable Products Regulation (ESPR) compromise text, published on 19 December 2023). [6] See Section 6.1.1 for additional details. |
| Weaving* | Weaving is the name given to the interleaving of two sets of yarns, warp and weft, at right angles. |

[6] The ESPR definition should be applied to qualify unsold consumer products and may be updated if further precision is provided by the Implementing or Delegated Act adopted by the European Commission. Its scope is therefore to include all consumer products fit for sale that were not sold, with the following interpretation.

# 1 Introduction

The Product Environmental Footprint (PEF) method provides detailed and comprehensive technical rules on how to conduct PEF studies that are more reproducible, consistent, robust, verifiable and comparable. Results of PEF studies are the basis for the provision of EF information and they may be used in a diverse number of potential fields of applications, including in-house management and participation in voluntary or mandatory programmes.

For all requirements not specified in this PEFCR the user of the PEFCR shall refer to the documents this PEFCR is in conformance with (see Section 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

The Technical Secretariat is responsible for the development of this PEFCR. It is made up of voting and non-voting members, as well as observers.

- Technical Secretariat members will aspire to define common positions through consensus. The TS defines consensus as the absence of sustained opposition.
- The meeting chair will actively pursue consensus among members.
- In case consensus cannot be reached, a vote will be organised. The overall position will be adopted by two-thirds majority.

To ensure TS members' equal representation in all votes referred to in the terms of reference, the voting rights are as follow:

- For voting members: each financially contributing organisation has one vote;
- For members joining the TS later on: each financially contributing organisation has one vote.

Inclusion in the list of Technical Secretariat members does not imply endorsement of the method.

Table 1 - PEFCR Apparel and Footwear TS members

| No. | Name of the organization | Type of organisation | Starting date of participation | Main contact(s) | Member status |
|---|---|---|---|---|---|
| 1 | Cascale | Industry association | January 2020 | Joël Mertens<br>Baptiste Carriere-Pradal | Secretariat lead<br>Voting |
| 2 | ADEME | Government agency | January 2020 as voting, January 2024 as non-voting | Maurine Poirier | Non-voting |
| 3 | Alliance for European Flax-Linen & Hemp | Industry association | January 2021 | Marie Demaegdt | Voting |
| 4 | C&A | Industry | January 2020 | Petra Fausten | Voting |
| 5 | Cotton Incorporated | Industry association | January 2020 | Michele Wallace | Voting |
| 6 | Décathlon | Industry | January 2020 | Laure Boissier<br>Quentin Badonnel | Voting |
| 7 | ECOS | NGO | December 2021 | Valeria Botta<br>Luca Boniolo | Non-voting |

| No. | Name of the organization | Type of organisation | Starting date of participation | Main contact(s) | Member status |
|---|---|---|---|---|---|
| 8 | FHCM | Industry association | January 2020 as non-voting, June 2020 as voting | Léonore Garnier | Voting |
| 9 | H&M | Industry | January 2020 | İpek Kurtoglu | Voting |
| 10 | Inditex | Industry | January 2020 | Beatriz Beaza Lopez De La Osa<br>Natalia Capelan Teijido<br>Germán García Ibáñez | Voting |
| 11 | Lacoste | Industry | February 2021 | Steve Duhamel<br>Frédéric LeCoq<br>Raynald Anquet | Voting |
| 12 | Nike Inc | Industry | January 2020 | Adam Brundage<br>Julia Riss | Voting |
| 13 | Refashion (Eco-TLC) | Industry association | January 2020 | Maud Hardy<br>Véronique Allaire Spitzer | Voting |
| 14 | Sympatex | Industry | January 2020 | Rüdiger Fox | Voting |
| 15 | VF Corporation | Industry | January 2020 | David Quass<br>Niccolo Gervasoni | Voting |
| 16 | W.L. Gore & Associates | Industry | January 2020 | Benjamin Bowers<br>Marie Mawe | Voting |
| 17 | CEC | Industry association | January 2020 | Carmen Arias<br>Matthieu Vicard<br>Maria Jose Ferreira | Non-voting |
| 18 | CNMI | Industry association | February 2021 | Chiara Luisi | Non-voting |
| 19 | COTANCE[7] | Industry association | January 2020 | Gustavo Gonzalez-Quijano | Non-voting |
| 20 | EURATEX | Industry association | January 2020 | Mauro Scalia | Non-voting |
| 21 | FESI | Industry association | January 2020 | Katarzyna Sulisz | Non-voting |
| 22 | IFF (Fur Europe) | Industry association | January 2020 | Marianne Coulavin | Non-voting |
| 23 | IWTO | Industry association | January 2020 as voting, January 2024 as non-voting | Jeanette Cook | Non-voting |
| 24 | European Commission EF Team | Government | January 2020 | Alicia Boyano Larriba | Observer |
| 25 | European Environmental Bureau (EEB) | NGO | January 2020 | Jean-Pierre Schweitzer | Observer |
| 26 | Ministry of Infrastructure & Watermanage-ment and its executive | Government | November 2023 | Madelon de Leeuw<br>Marije Slump | Observer |

[7] COTANCE withdrew their membership from the Technical Secretariat in April 2025

| No. | Name of the organization | Type of organisation | Starting date of participation | Main contact(s) | Member status |
|---|---|---|---|---|---|
| | agency Rijkswaterstaat | | | | |
| 27 | 2BPolicy | Consultant | March 2020 | Baptiste Carriere-Pradal<br>Svenja Frøhlich Balkhausen | Technical facilitation |
| 28 | Quantis | Consultant | January 2020 | Conrad Leuthold<br>Mireille Faist | Technical expert |

## 2.2 Consultations and stakeholders

Given the large number of participants, the names of organisations and individuals participating in the public consultations on this PEFCR are provided in ANNEX IX – List of organisations and individuals participating in the public consultations.

**First public consultation**

The first public consultation took place from 7 July 2021 to 24 September 2021, on the PEFCR for apparel and footwear stakeholder workspace.

A total of 996 comments were received from more than 80 organisations and individuals.

**Second public consultation**

The second public consultation took place from 18 March 2024 to 28 April 2024, on the PEFCR for apparel and footwear stakeholder workspace.

A total of 5119 comments were received from more than 250 organisations and individuals.

## 2.3 Review panel and review requirements of the PEFCR

The names and the affiliations of the members of the review panel are listed in Table 2 below.

Table 2 - PEFCR Apparel and Footwear review panel

| Name of the member | Affiliation | Role |
|---|---|---|
| Ugo Pretato | Studio Fieschi & soci | Chair – LCA expert |
| Laurent Maeder | Maeder Conseils | Industry expert |
| Sonia Valdivia | World Resources Forum | NGO representative |

The reviewers have verified that the following requirements are fulfilled:

- The PEFCR has been developed in accordance with the requirements provided in Annex I and Annex II of the PEF method ;
- The PEFCR supports the creation of credible, relevant and consistent PEF profiles;
- The PEFCR scope and the representative products are adequately defined;
- The functional unit, allocation and calculation rules are adequate for the product category under consideration;
- Datasets used in the PEF-RPs and the supporting studies are relevant, representative, reliable, and in compliance with data quality requirements;
- The selected additional environmental and technical information are appropriate for the product category under consideration and the selection is done in accordance with the requirements stated in Annex I of the PEF method,
- The model of the RP and corresponding benchmark (if applicable) represent correctly the product category or sub-category;
- The RP model in its corresponding Excel version is compliant with the rules outlined in Section A.2.3 of Annex II of the PEF method;
- The Data Needs Matrix is correctly implemented;
- The classes of performance, if identified, are appropriate for the product category.

The public review reports are provided in ANNEX III – Review reports of the PEFCR and PEF-RP(s) of this PEFCR.

## 2.4 Review statement

This PEFCR was developed in compliance with the PEF Method adopted by the Commission on 16 December 2021 (Recommendation 2279/2021).

The representative products correctly describe the average products sold in Europe (EU + EFTA) for the product sub-categories 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 Section on limitations 3.8 and 3.8.1).

The review panel members confirm that they have been independent in their role in accordance with the requirements of the Recommendation 2021/2279 and they have no conflicts of interest regarding this review.

The review panel wishes to thanks the Technical Secretariat for the open and constructive collaboration during the review of the various PEFCR versions and related RP studies and supporting studies.

The review panel wishes to highlight the following points that need special attention in applying the PEFCR and that should be addressed in future updates of the document:

- The complexity and the broad scope of this PEFCR requires a special care when results of PEF studies are used in support of comparisons and comparative assertions intended to be disclosed to the public: PEFCR applicants are invited to strictly follow the indications of section 3.8.1 of the PEFCR. A future version of the PEFCR should further detail and improve the conditions to perform comparisons and comparative assertions
- The requirements on mandatory company-specific data take into account the current limitations on the origin and traceability of raw materials across the apparel and footwear supply chains. A future version of the PEFCR should consider the feasibility of increasing the collection of specific data throughout the supply chains

- A future version of the PEFCR should simplify the data collection and modelling of the distribution stage, as the impact for all the product sub-categories is generally not relevant compared to the other life cycle stages
- The environmental footprint results of all apparel and footwear products will be largely influenced by the achieved scores on intrinsic durability and repairability multipliers (IDM and RM). In such perspective it is essential that such parameters are carefully checked during PEF study verifications and that the verification team includes specific expertise on apparel and footwear processes and technologies. A future version of the PEFCR should in addition improve the consideration of the extrinsic dimension of apparel and footwear products as outlined in Annex VI.

## 2.5 Geographic validity

This PEFCR is valid for products in scope sold or 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):

- Product Environmental Footprint (PEF) method

| Note | The PEFCR currently does not conform to any other documents than the PEF method. |
| --- | --- |

# 3 PEFCR scope

The product category for this PEFCR is apparel and footwear, which is defined as follows:

- **An apparel or footwear product to meet the consumer's specific needs, as defined per sub-category**

The full life cycle (cradle to grave) for apparel and footwear sold in the EU market is within the scope of this PEFCR. Additionally, this PEFCR could also be used to assess partial life cycle impacts of products included in this category.

Exceptional pieces (see

**Definitions** Section) are the result of intangible cultural heritage and high art craftsmanship which are made to be worn on specific occasions such as artistic representations, ceremonial or formal dress. They can represent from 5 hours up to 100 hours per piece of handmade processes or handicraft. They cannot be categorised following product sub-categories as seen in Table 4, and are not necessarily intended to meet consumers' needs.

They also have inconsistent care cycles with delicate components, e.g., a craft embellishment cannot be washed a wedding dress is single use, etc. As a result, they are not included in the scope of this PEFCR.

Finally, this PEFCR is applicable to products not yet on the EU market provided that the following three conditions are met:

1. The product will be launched on the EU market within the next 18 months from the publication date of the study;
2. The company is already selling similar products (e.g., same product sub-category) on the EU market;
3. The company can access the relevant mandatory primary data points (unsold consumer products quantity and air cargo distribution distance).

Thirteen different sub-categories are included in this PEFCR as described in Table 4.

Workwear is only partially included in the scope:

- Uniforms (e.g. for airline crew, hotel staff, etc.) should be modelled using the most relevant product sub-category from Table 4;
- Protective wear is not in scope as its main protective function will require different materials, processes, testing etc.

Protective wear is defined as designed to be worn by an individual for protection against one or more health and safety hazards (interpretation from ISO45005).

## 3.1 Product classification

The CPA/NACE codes for the products included in this PEFCR are provided in Table 3 below. Due to the categorization of products in the CPA/NACE system, some codes

are listed (for the reason of completeness) containing products that belong to the respective sub-category, but also products that belong to other sub-categories. Therefore, this table is indicative only, and the most relevant product sub-category for a PEF study shall be found using Table 4.

Table 3 - CPA/NACE codes per product sub-category

| Product sub-category | CPA/NACE code |
|---|---|
| 1. T-shirts | 14.14.30 T-shirts, singlets and other vests, knitted or crocheted |
| | 14.14.22 Men's or boys' singlets and other vests, underpants, briefs, nightshirts, pyjamas, bathrobes, dressing gowns, of textile fabric not knitted or crocheted |
| | 14.14.24 Women's and girls' singlets and other vests, slips, petticoats, briefs, panties, nightdresses, pyjamas, negligees, bathrobes, dressing gowns and similar articles, of textile fabric not knitted or crocheted |
| 2. Shirts and blouses | 14.14.11 Men's or boys' shirts, knitted or crocheted |
| | 14.14.13 Women's or girls' blouses, shirts and shirt- blouses, knitted or crocheted |
| | 14.14.21 Men's or boys' shirts, of textile fabric not knitted or crocheted |
| | 14.14.22 Men's or boys' singlets and other vests, underpants, briefs, nightshirts, pyjamas, bathrobes, dressing gowns, of textile fabric not knitted or crocheted |
| | 14.14.23 Women's or girls' blouses, shirts and shirt- blouses, of textile fabric not knitted or crocheted |
| | 14.14.24 Women's and girls' singlets and other vests, slips, petticoats, briefs, panties, nightdresses, pyjamas, negligees, bathrobes, dressing gowns and similar articles, of textile fabric not knitted or crocheted |
| 3. Sweaters and midlayers | 14.19.12 Tracksuits, ski suits, swimwear and other garments, knitted or crocheted |
| | 14.39.10 Jerseys, pullovers, cardigans, waistcoats and similar articles, knitted or crocheted |
| 4. Jackets and coats | 14.12.11 Men's ensembles, jackets and blazers, industrial and occupational |
| | 14.12.21 Women' s ensembles, jackets and blazers, industrial and occupational |
| | 14.13.11 Men's or boys' overcoats, car coats, capes, cloaks, anoraks, windcheaters, wind-jackets and similar articles, knitted or crocheted |
| | 14.13.12 Men's or boys' suits, ensembles, jackets, blazers, trousers, bib and brace overalls, breeches and shorts, knitted or crocheted |
| | 14.13.13 Women's or girls' overcoats, car coats, capes, cloaks, anoraks, windcheaters, wind-jackets and similar articles, knitted or crocheted |
| | 14.13.14 Women's or girls' suits, ensembles, jackets, blazers, dresses, skirts, divided skirts, trousers, bib and brace overalls, breeches and shorts, knitted or crocheted |
| | 14.13.21 Men's or boys' overcoats, raincoats, car coats, capes, cloaks, anoraks, wind-cheaters, wind-jackets and similar articles of textile fabrics, not knitted or crocheted |

| Product sub-category | CPA/NACE code |
|---|---|
| | 14.13.22 Men's or boys' suits and ensembles of textile fabrics, not knitted or crocheted |
| | 14.13.23 Men's or boys' jackets and blazers, of textile fabrics, not knitted or crocheted |
| | 14.13.31 Women's or girls' overcoats, car coats, capes, cloaks, anoraks, wind-cheaters, wind-jackets and similar articles of textile fabrics, not knitted or crocheted |
| | 14.13.32 Women's or girls' suits and ensembles of textile fabrics, not knitted or crocheted |
| | 14.13.33 Women's or girls' jackets and blazers of textile fabrics, not knitted or crocheted |
| | 14.14.22 Men's or boys' singlets and other vests, underpants, briefs, nightshirts, pyjamas, bathrobes, dressing gowns, of textile fabric not knitted or crocheted |
| | 14.14.24 Women's and girls' singlets and other vests, slips, petticoats, briefs, panties, nightdresses, pyjamas, negligees, bathrobes, dressing gowns and similar articles, of textile fabric not knitted or crocheted |
| | 14.14.30 T-shirts, singlets and other vests, knitted or crocheted |
| | 14.19.12 Tracksuits, ski suits, swimwear and other garments, knitted or crocheted |
| 5. Pants and shorts | 14.12.11 Men's ensembles, jackets and blazers, industrial and occupational |
| | 14.12.12 Men's trousers, bib and brace overalls, breeches and shorts, industrial and occupational |
| | 14.12.21 Women' s ensembles, jackets and blazers, industrial and occupational |
| | 14.12.22 Women's trousers, bib and brace overalls, breeches and sorts, industrial and occupational |
| | 14.13.12 Men's or boys' suits, ensembles, jackets, blazers, trousers, bib and brace overalls, breeches and shorts, knitted or crocheted |
| | 14.13.14 Women's or girls' suits, ensembles, jackets, blazers, dresses, skirts, divided skirts, trousers, bib and brace overalls, breeches and shorts, knitted or crocheted |
| | 14.13.22 Men's or boys' suits and ensembles of textile fabrics, not knitted or crocheted |
| | 14.13.24 Men's or boys' trousers, bib and brace overalls, breeches and shorts of textile fabrics, not knitted or crocheted |
| | 14.13.32 Women's or girls' suits and ensembles of textile fabrics, not knitted or crocheted |
| | 14.13.35 Women's or girls' trousers, bib and brace overalls, breeches and shorts of textile fabrics, not knitted or crocheted |
| | 14.14.22 Men's or boys' singlets and other vests, underpants, briefs, nightshirts, pyjamas, bathrobes, dressing gowns, of textile fabric not knitted or crocheted |
| | 14.14.24 Women's and girls' singlets and other vests, slips, petticoats, briefs, panties, nightdresses, pyjamas, negligees, bathrobes, dressing gowns and similar articles, of textile fabric not knitted or crocheted |
| | 14.19.12 Tracksuits, ski suits, swimwear and other garments, knitted or crocheted |

| Product sub-category | CPA/NACE code |
|---|---|
| | 14.19.22 Tracksuits, ski suits and swimwear; other garments of textile fabric, not knitted or crocheted |
| 6. Dresses, skirts and jumpsuits | 14.12.11 Men's ensembles, jackets and blazers, industrial and occupational |
| | 14.12.21 Women' s ensembles, jackets and blazers, industrial and occupational |
| | 14.13.14 Women's or girls' suits, ensembles, jackets, blazers, dresses, skirts, divided skirts, trousers, bib and brace overalls, breeches and shorts, knitted or crocheted |
| | 14.13.22 Men's or boys' suits and ensembles of textile fabrics, not knitted or crocheted |
| | 14.13.32 Women's or girls' suits and ensembles of textile fabrics, not knitted or crocheted |
| | 14.13.34 Women's or girls' dresses, skirts and divided skirts of textile fabrics, not knitted or crocheted |
| | 14.14.12 Men's or boys' underpants, briefs, nightshirts, pyjamas, bathrobes, dressing gowns and similar articles, knitted or crocheted |
| | 14.14.14 Women's or girls' slips, petticoats, briefs, panties, nightdresses, pyjamas, dressing gowns, negligees, bathrobes and similar articles, knitted or crocheted |
| | 14.14.22 Men's or boys' singlets and other vests, underpants, briefs, nightshirts, pyjamas, bathrobes, dressing gowns, of textile fabric not knitted or crocheted |
| | 14.14.24 Women's and girls' singlets and other vests, slips, petticoats, briefs, panties, nightdresses, pyjamas, negligees, bathrobes, dressing gowns and similar articles, of textile fabric not knitted or crocheted |
| 7. Leggings, stockings, tights and socks | 14.31.10 Panty hose, tights, stockings, socks and other hosiery, knitted or crocheted |
| | 15.20.40 Parts of footwear of leather; removable insoles, heel cushions and similar articles; gaiters, leggings and similar articles, and parts thereof |
| 8. Underwear | 14.14.12 Men's or boys' underpants, briefs, nightshirts, pyjamas, bathrobes, dressing gowns and similar articles, knitted or crocheted |
| | 14.14.14 Women's or girls' slips, petticoats, briefs, panties, nightdresses, pyjamas, dressing gowns, negligees, bathrobes and similar articles, knitted or crocheted |
| | 14.14.22 Men's or boys' singlets and other vests, underpants, briefs, nightshirts, pyjamas, bathrobes, dressing gowns, of textile fabric not knitted or crocheted |
| | 14.14.24 Women's and girls' singlets and other vests, slips, petticoats, briefs, panties, nightdresses, pyjamas, negligees, bathrobes, dressing gowns and similar articles, of textile fabric not knitted or crocheted |
| | 14.14.25 Brassieres, girdles, corsets, braces, suspenders, garters and similar articles and parts thereof, whether or not knitted or crocheted |
| | 17.22.12 Sanitary towels and tampons, napkins and napkin liners for babies and similar sanitary articles and articles of apparel and clothing accessories, of paper pulp, paper, cellulose wadding or webs of cellulose fibres |
| 9. Swimwear | 14.19.12 Tracksuits, ski suits, swimwear and other garments, knitted or crocheted |
| | 14.19.22 Tracksuits, ski suits and swimwear; other garments of textile fabric, not knitted or crocheted |

| Product sub-category | CPA/NACE code |
|---|---|
| 10. Apparel accessories | 14.14.25 Brassieres, girdles, corsets, braces, suspenders, garters and similar articles and parts thereof, whether or not knitted or crocheted |
| | 14.19.13 Gloves, mittens and mitts, knitted or crocheted |
| | 14.19.19 Other made-up clothing accessories and parts of garments or of clothing accessories, knitted or crocheted |
| | 14.19.23 Handkerchiefs, shawls, scarves, veils, ties, cravats, gloves and other made-up clothing accessories; parts of garments or of clothing accessories, of textile fabric, not knitted or crocheted, n.e.c. |
| | 14.19.31 Clothing accessories of leather or of composition leather, except sports gloves |
| | 14.19.41 Hat forms, hat bodies and hoods of felt; plateaux and manchons of felt; hat shapes, plaited or made by assembling strips of any material |
| | 14.19.42 Hats and other headgear, of felt, or plaited or made by assembling strips of any material, or knitted or crocheted or made up from lace or other textile fabric in the piece; hairnets |
| | 22.29.10 Apparel and clothing accessories (including gloves), of plastics |
| 11. Open-toed shoes | 15.20.12 Footwear with outer soles and uppers of rubber or plastics, other than waterproof or sports footwear |
| | 15.20.13 Footwear with uppers of leather, other than sports footwear, footwear incorporating a protective metal toe-cap and miscellaneous special footwear |
| | 15.20.14 Footwear with uppers of textile materials, other than sports footwear |
| | 15.20.32 Wooden footwear, miscellaneous special footwear and other footwear n.e.c. |
| 12. Closed-toed shoes | 15.20.12 Footwear with outer soles and uppers of rubber or plastics, other than waterproof or sports footwear |
| | 15.20.13 Footwear with uppers of leather, other than sports footwear, footwear incorporating a protective metal toe-cap and miscellaneous special footwear |
| | 15.20.14 Footwear with uppers of textile materials, other than sports footwear |
| | 15.20.32 Wooden footwear, miscellaneous special footwear and other footwear n.e.c. |
| | 15.20.11 Waterproof footwear, with outer soles and uppers of rubber or plastics, other than footwear incorporating a protective metal toe-cap |
| | 15.20.21 Tennis shoes, basketball shoes, gym shoes, training shoes and the like |
| | 15.20.29 Other sports footwear, except snow-ski footwear and skating boots |
| | 15.20.31 Footwear incorporating a protective metal toe-cap |
| 13. Boots | 15.20.11 Waterproof footwear, with outer soles and uppers of rubber or plastics, other than footwear incorporating a protective metal toe-cap |
| | 15.20.12 Footwear with outer soles and uppers of rubber or plastics, other than waterproof or sports footwear |
| | 15.20.13 Footwear with uppers of leather, other than sports footwear, footwear incorporating a protective metal toe-cap and miscellaneous special footwear |
| | 15.20.14 Footwear with uppers of textile materials, other than sports footwear |

| Product sub-category | CPA/NACE code |
|---|---|
| | 15.20.21 Tennis shoes, basketball shoes, gym shoes, training shoes and the like |
| | 15.20.29 Other sports footwear, except snow-ski footwear and skating boots |
| | 15.20.31 Footwear incorporating a protective metal toe-cap |

The following codes apply to several product categories and have not been added to this table, but are included in this PEFCR:

- 14.11.10 Apparel of leather or of composition of leather
- 14.19.11 Babies' garments and clothing accessories, knitted or crocheted
- 14.19.21 Babies' garments and clothing accessories, of textile fabric, not knitted or crocheted
- 14.19.32 Garments made up of felt or nonwovens, textile fabrics impregnated or coated
- 14.20.10 Articles of apparel, clothing accessories and other articles of fur skin, except headgear

## 3.2 Representative products

The PEF study of the representative products (PEF-RP) is available upon request to the TS coordinator that has the responsibility of distributing it with an adequate disclaimer about its limitations.
The product category includes apparel and footwear products sold in Europe.

This PEFCR covers 13 virtual representative products per the products sub-categories defined in Table 4 below. If the product under study is made of multiple parts (e.g. a suit composed of a jacket and a pair of pants, or a pack of three pairs of socks), the most relevant category for each part shall be selected to conduct a partial footprint, and the sum of the partial footprints shall be done to calculate the full product's footprint.

ANNEX IV – Designing the representative product model, describes the steps taken to define the RP model.

Table 4 - Product sub-categories and descriptions

| No. | Sub-category/ representative product | Typical products included | Description and intended function |
|---|---|---|---|
| 1 | T-shirts | Singlets, t-shirts, polo shirts, other short-sleeved shirts | Garment to cover the upper body to the elbow |
| 2 | Shirts and blouses | Long-sleeved shirts, blouses, tunics, base layers | Garment to cover the upper body including the entire arm |
| 3 | Sweaters and midlayers | Pullovers, cardigans, hoodies, jerseys, sweatshirts, knitted and wool sweaters, vests | Garment to keep the upper body warm and covered |
| 4 | Jackets and coats | Blazers, suit jackets, overcoats, other light jackets, rain jackets, outdoor winter jackets, parkas, down jackets, fur jackets, outdoor vests, leather jackets | Garment to put on top of a shirt or sweater or to protect from the elements |
| 5 | Pants and shorts | Casual pants, outdoor pants, dress pants, jeans, sports pants, capri pants, shorts | Garment to cover the lower body, may protect from the elements |
| 6 | Dresses, skirts and jumpsuits | Short- and long-sleeved, strapless, wrap, long and short, one-piece suits | One-piece garment that covers both the upper and lower body, or the lower body only, other than pants and shorts |
| 7 | Leggings, stockings, tights and socks | Opaque and sheer tights, pantyhose, fishnets, ankle socks, knee socks, low-cut socks | Tight garment to cover the legs and/or feet |
| 8 | Underwear | Boxers, briefs, panties, bras, body-shaping suits | Garment worn under clothes, often next to the skin of the upper or lower body |
| 9 | Swimwear | Bikinis, bathing suits, racing-style swimwear, board shorts | Garment worn for water-based or sun-based activities |
| 10 | Apparel accessories | **Hats:** Caps, flat caps, woollen hats/beanies, fedoras, panamas, bowlers, newsboys, berets | Garment to cover the head |
| | | **Scarves and ties**: Warm and light scarves, buffs, neckerchiefs, headscarves, shawls, bowties | Garment worn around the neck |
| | | **Belts:** Dress belts, casual belts, buckle belts, tie-up belts, suspenders | Flexible band or strap worn around the waist or over the shoulders used to secure or to hold up clothing such as pants |
| | | **Gloves and mittens:** fingerless gloves, fashion gloves, outdoor sports gloves, mittens | Articles of clothing that protect hands and wrists from the elements. Used in pairs. |
| 11 | Open-toed shoes | Flip-flops, casual /fashion sandals, sports sandals, slippers | Open-toed shoes, providing protection from the ground. Used in pairs. |
| 12 | Closed-toed shoes | Slippers, tennis shoes, moccasins, espadrilles, sneakers, cleats, athletic shoes, dress shoes, protective toecap – toed shoes | Closed-toed shoes, providing protection from the ground. They may protect against water, the elements and/or heavy objects. Used in pairs. |
| 13 | Boots | Polymer boots, winter boots, hiking boots, dress boots, protective toecap - toed boots | Boots that cover the ankle, providing protection from the ground. They may protect against water, the elements, heavy objects and/or ankle injuries. Used in pairs. |

According to the criterion in Table 4 for RP 11 to 13 which states that the function of the footwear is “providing protection from the ground”, cycling footwear is excluded from this PEFCR.

## 3.3 Functional unit and reference flow

The functional unit (FU) is to provide an apparel or footwear product to meet the user’s specific needs for one use, as defined per sub-category. Table 5 below defines the key aspects used to define the FU.

Table 5 - Key aspects to determine the unit of analysis

| Aspect | Aspect detail | Description |
|---|---|---|
| What? | Function provided | To provide an apparel or footwear product to meet the consumer’s needs, as defined per sub-category in Table 4 |
| How much? | Magnitude of the function | One apparel product, one pair of socks or one pair of footwear as defined by a bill of materials. |
| How well? | Expected level of quality | Wear in good condition with appropriate use for the given product, as defined per sub-category in Section 3.3.3. |
| How long? | Duration of the product provided | One use which includes aspects such as duration of service, or lifetime, care cycles per lifetime and quality, as defined per sub-category. |

The consumers’ needs can vary quite widely for an apparel or footwear product, as they can for example be related to work, to performing sports, enjoying leisure, to protection purposes, or simply to the needs of the consumers to express themselves.

«In good condition» means that the product does not present any of the defects that would trigger the consumer to discard it, as defined by the intrinsic durability tests presented in ANNEX V – Detailed requirements regarding intrinsic durability.
A use is defined as a 24-hour period, regardless of how many hours the apparel or footwear product is worn within this 24-hour period. A use may not always include a washing step as some products only require washing after a few uses as described in Table 40. Both the “how well” and “how long” aspects will be dependent on the intrinsic and extrinsic quality of the product, and its repairability. With an extended lifetime, the impact of the use stage could be higher (e.g. more washes), however the impact of the production (LCS 1 + LCS 2) will be lower per use. Products that fail to meet

baseline quality requirements will have a higher overall impact. See Section 3.3.3 for more information.

The average product lifetime per sub-category is defined in Section 3.3.2.

Whilst product longevity also depends on consumer care, the functional unit only focusses on aspects that are within the apparel and footwear manufacturers' control.

For communication purposes, a product is defined by an individual and unique specific material composition, material construction, fabric weight or material density, dyeing method as well as fabric or material treatment and finishes. To calculate the footprint of the product (including any variation), a weighted production volume average of the score of the individual variations shall be calculated to be used for the elaboration of the BOM. For example, if for a cotton shirt, a variation necessitates a certain type of cotton dyeing for dark colours and the other variation another type of dyeing for light colours, the amount of dyeing of the corresponding technology will be calculated for the BOM based on the corresponding production volumes. The weighted production volume average shall be based on effective sales during the most recent annual administration period on the European market if possible, or on forecasted sales otherwise. This shall be done at product level, if possible, sub-category level otherwise.

The reference flow is the amount of product needed to fulfil the defined function and shall be measured in the fraction of the life cycle of the specific apparel or footwear product studied.

For example, for a t-shirt with a lifetime of 45 uses, the reference flow will be $1/45^{th}$ of the t-shirt.

All quantitative input and output data collected in the study shall be calculated in relation to this reference flow.

| Note | As indicated in the PEF method, *if the product lifetime is extended into a product with original product specifications (providing the same function) these processes shall be included in the FU and reference flow. […] The user of the PEF method shall describe how reuse or refurbishment is included in the calculations of the reference flow and the full life cycle model, taking into account the "how long" of the FU.* |
|---|---|

### 3.3.1 Guidance on sizing

As detailed in Table 5, a product is defined by a Bill Of Materials (BOM), which accounts for multiple sizes using the concept of grading. Material consumption is not tied to the product net weight, but to the bill of materials consumption, which also includes other assembly losses beyond patterning.

However, some companies will only have access to the final product weight. These companies shall use this section to estimate the BOM for their product. Companies that have access to their BOM shall use them.

First, the company shall use their internal reference size and convert it to the associated reference size below (based on TS expertise), using the conversion factors in Figure 1.

For apparel, the following medium sizes shall be used:

- Infants: (0 to 2 years): EU size 6 months (68 cm)
- Children (2 to 8 years): EU size 4 years (104 cm)
- Children (9 to 14 years): EU size 10 years (140 cm)
- Women: EU size 38
- Men (suits/blazers): EU size 50
- Men (other products): size M
- Unisex: EU size 40
- Bras: EU size 75B

For footwear, the following medium sizes shall be used:

- Infants: EU size 21
- Children: EU size 32

- Women: EU size 38
- Men: EU size 42
- Unisex: EU size 39

In case a product size range covers two sizes (e.g. a product for children manufactured in sizes 2 to 14 years old), the user of the PEFCR shall run the score calculations twice after amending the bill of materials if needed. Everything else will remain the same and two scores will be obtained.

The number obtained shall then be extrapolated to the BOM using the assembly loss rate (a mandatory data point as indicated in Section 5.1), as illustrated in Figure 1 below for apparel and Figure 2 for footwear.

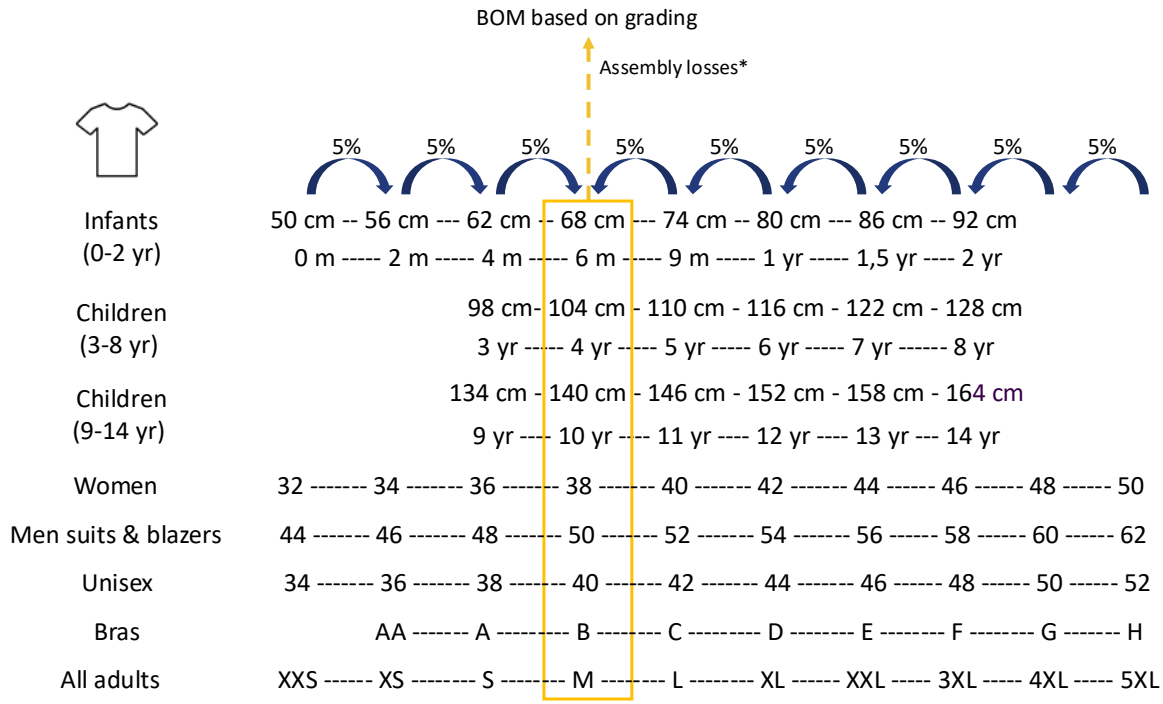



Figure 1 - Retro-calculating the BOM for apparel

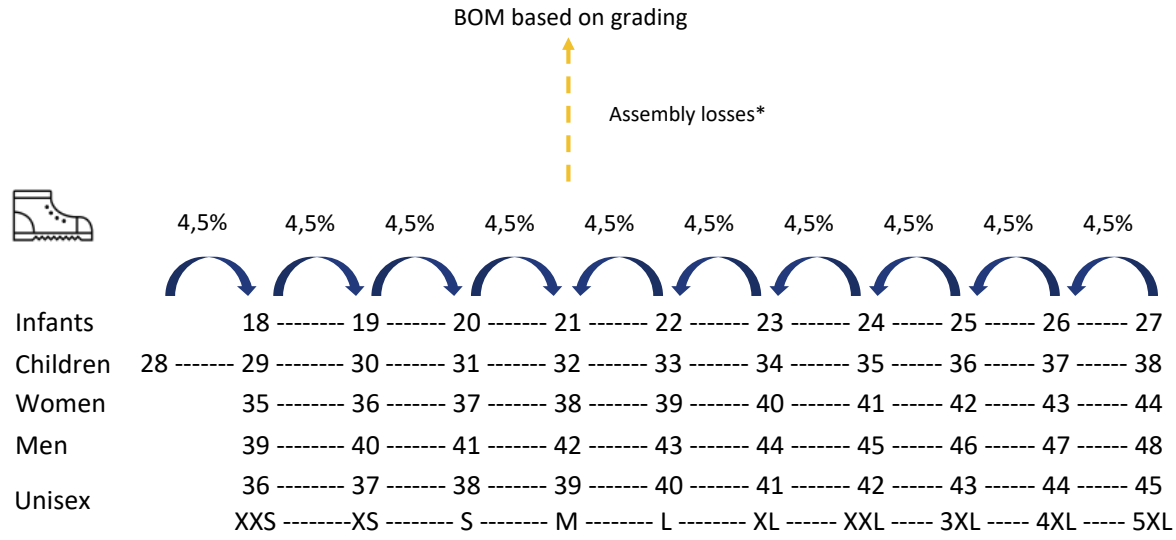



Figure 2 - Retro-calculating the BOM for footwear

*Assembly losses are a mandatory primary data point for the retro calculation of the BOM.

In the case of bras, the 5% increase refers to the **cup size**.

The retro-calculated BOM shall then be used to calculate the product's environmental footprint.

**Illustrative example:**

A women's t-shirt in EU size 40 weighs 100g and is made up of 80% cotton and 20% polyester. This company's assembly loss rate is 20% for t-shirts.

1. This t-shirt will have the following weight in the reference size (EU size 38) = 100/1.05 = 95.23g
2. Using the assembly loss rate, the product "weight" before assembly is = 95.23*1.20 = 114.28g, rounded to 114g
3. Based on the initial material ratio, the retro-calculated BOM is 91g of cotton and 23g of polyester, to be used in the product footprint calculations

As a note, sizing is irrelevant as a product differentiator since consumers will need to buy the size that fits them.

### 3.3.2 Product lifetime

#### 3.3.2.1 Introduction

For the lifetime, the concept of the "duration of service" (DoS) from the Higg Product Module (PM) methodology is used where the duration of service is defined as *"the lifetime of the product with appropriate use for its intended function".* The product's intended function is described in Table 4. A product is used "appropriately" when it is used according to its intended function (e.g. if a hat is used as a sock, its duration of service may vary).

According to this definition, the default duration of service is independent from the number of users. For example, by default, a t-shirt will be used 45 times in its lifetime, which could be:

- 45 uses with the same user;
- 20 uses with a first user, and 25 uses with a second user after the t-shirt has been donated for reuse.

This PEFCR aims to reflect the real-life DoS of apparel and footwear as closely as possible. Product lifetime is estimated by assessing:

i. The intrinsic durability of a product – product-specific attributes that contribute to its potential lifetime (e.g. physical toughness and design features);
ii. Extrinsic durability attributes - external factors that influence the likelihood of a product reaching its potential lifetime;
iii. The repairability potential of the product.

This PEFCR includes a number of intrinsic (see Section 3.3.3) and repairability attributes (see Section 3.3.4). ANNEX VI – Exploring the extrinsic durability of apparel and footwear products lists extrinsic attributes and other intrinsic and repairability attributes that may be included in future versions of this PEFCR, where a causal link to DoS is proven. In the meantime, an extrinsic durability multiplier of 1 is considered for all products.

The multipliers included in this section can be combined should the product qualify both for an intrinsic durability multiplier and a repairability multiplier.

For example, for a t-shirt qualifying for an intrinsic durability multiplier of 1.17 and a repairability multiplier of 1.05, the combined DoS multiplier becomes 1.17*1.05 = 1.23. The default duration of service as given in Section 3.3.2.2 can therefore be multiplied by a combined DoS multiplier depending on certain criteria described in Section 3.3.3.

#### 3.3.2.2 Default duration of service

Table 6 below lists the number of uses per product sub-category based on Cascale (2020) for apparel, and expert judgement for footwear. The presented default lifetime shall only be modified by the multipliers presented in Section 3.3.3 and 3.3.4.

Table 6 - Default product duration of service per product sub-category

| No. | Product sub-category | Product | Number of uses per product duration of service[8] |
|---|---|---|---|
| 1 | T-shirts | Average | 45[9] |
| 2 | Shirts and blouses | Average | 40 |
| 3 | Sweaters and midlayers | Average | 85 |
| 4 | Jackets and coats | Average | 100 |
| 5 | Pants and shorts | Average | 70 |
| 6 | Dresses, skirts and jumpsuits | Average | 70 |
| 7 | Leggings, stockings, tights and socks | Average | 55 |
| | | Leggings/tights | 70 |
| | | Hosiery | 50 |
| | | Socks | 50 |
| 8 | Underwear | Average | 60 |
| 9 | Swimwear | Average | 30 |
| 10 | Apparel accessories | Average | 100 |
| 11 | Open-toed shoes | Average | 50 |
| 12 | Closed-toed shoes | Average | 100 |
| 13 | Boots | Average | 100 |

A duration of service of one use shall be used for items clearly identified as single use items (e.g. “for single use”).

[8] The number of uses per duration of service includes all kinds of reuses such as consumer to consumer donation, reuse at end of life or reuse of donated unsold consumer products

[9] Calculated based on the percentages of the fibre types in the RP.

| Note | Scientific evidence was missing at this stage to define different default durations of service for apparel products made up of materials different from textiles (e.g. leather, fur), but such an amendment to Table 7 is highly recommended in a future version of the PEFCR. |
|---|---|

The numbers included above are independent from the number of users. The reuse rate of apparel products is 23%, and 10% for footwear as detailed in Section 5.10. In literature, re-commerce models are evaluated as allowing to extend the average product life up to 1.7 times, based on average length of second-hand ownership (Cline E., 2019). As a result, the lifetime extension due to reuse would be 16% for apparel products and 7% for footwear. Due to the limited number of robust consumer studies conducted, the numbers included in Table 6 have a high uncertainty. A conservative approach has then been followed and a lifetime extension due to reuse has not been integrated to the default DoS.

For the determination of the specific duration of service, the default duration of service combined with the corresponding duration of service factors (supported with evidence) shall be used. The methodology is described in the two following Sections 3.3.3 (for the Intrinsic Durability Multiplier IDM) and 3.3.4 (for the Repairability Multiplier RM). The specific duration of service is therefore:

$$Specific\ DoS = Default\ DoS\ \times IDM\ \times\ RM$$

Equation 1 - Calculation of specific duration of service

As the IDM multiplier can reach a maximum $IDM_{Max}$ of 1.45 and a minimum $IDM_{Min}$ of 0.67 (see Section 3.3.3.3) and the Repairability Multiplier (RM) a maximum $RM_{Max}$ of 1.15 and a minimum $RM_{Min}$ of 1, the specific duration of service can reach a maximum and a minimum of:

$$Specific\ DoS = Default\ DoS\ \times IDM\ \times\ RM$$

$$= \begin{cases} maximum: Default\ DoS \times IDM_{Max} \times RM_{Max}\ = Default\ DoS \times 1.45 \times\ 1.15 = Default\ DoS\ \times 1.6675 \\ minimum: Default\ DoS \times IDM_{Min} \times RM_{Min} = Default\ DoS \times 0.67 \times\ 1 = Default\ DoS \times 0.67 \end{cases}$$

Equation 2 - Calculation of the maximum and minimum specific duration of service

### 3.3.3 Intrinsic durability

This PEFCR intends to support product eco-design to extend product lifetime by evaluating the environmental performance of products with respect to their intended function, series size and their expected possible failures. Product testing for Duration of Service (DoS) to prevent associated product failure risks can represent a high economic cost (laboratory tests and external verification or certification) as well as an environmental burden (energy resources to test duration of service care cycles, possible material or product destruction).

Therefore, DoS tests can only be appropriate when:

- Tests are aligned with the product's intended function;
- Tests are predicting product end-of-life (EoL) potential factors;
- Tests are economically and environmentally relevant: number of tests need to be adjusted to product series size for economic accessibility to companies of all sizes. When applied to large product series, economies of scale are possible and DoS testing is suitable (e.g. the cost ratio is 1/100,000 produced units against 1/1,000 produced units for a small series). When applied to small product series, the cost of DoS testing is too high and needs to be adjusted to the degree of product failure risks.

This section is split into three sections:

- Section 3.3.3.1 describes the further segmentation of the product under study to select the product's testing protocol defined in ANNEX V – Detailed requirements regarding intrinsic durability.
- Section 3.3.3.2 describes the assessment of the product's intrinsic durability based on the conducted durability and functionality tests. Based on the test results, a normalized test point for each test is assigned.
- Section 3.3.3.3 describes the conversion of the individual normalized test results from the durability testing to the final Intrinsic Durability Multiplier (IDM) for the product.

Examples of the calculation of the IDPS and IDM of fictional products is provided in Part V in ANNEX V – Detailed requirements regarding intrinsic durability.

All tests shall be conducted on only one size of garment and the results applied to all sizes.

| Note | The intrinsic durability tests are optional, and though highly recommended, not mandatory. A default intrinsic durability multiplier of 0.67 shall be used should no intrinsic durability tests be conducted (except for exemptions mentioned in Section 3.3.3.2). |
|---|---|

#### 3.3.3.1 Segmentation

To ensure that the most relevant tests are used to differentiate products' physical durability performance, the following sub-category segmentations will define a product's testing protocol. The segmentation methodology groups segments of the subcategories based on their intended use, technicity, and the age group (footwear only) of the intended users. The rationale for this segmentation is that not all tests are relevant to all products within a sub-category, and even with the same tests, there are different thresholds and weighting, which should be applied depending on the use case and user age of different product segments within a sub-category. The intent of these physical durability testing protocols is not to change the fundamental duration of service for a given product within a sub-category, but rather to assess the duration of service for a product within a sub-category through its most relevant lens.
The definitions of the segments can be found in ANNEX V – Detailed requirements regarding intrinsic durability.

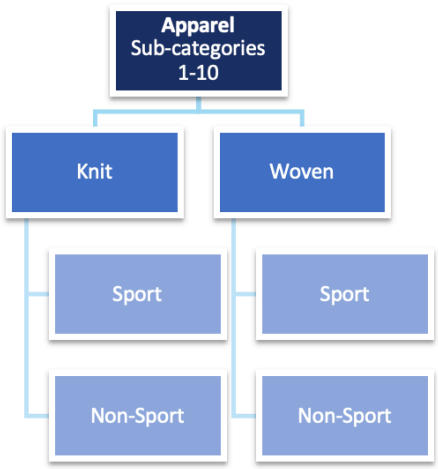
| Note | Clarifications on which tests need to be conducted on different variations of the same product are provided in Part I in ANNEX V – Detailed requirements regarding intrinsic durability. |
|---|---|

**Apparel (subcategories 1-10)**

The segmentation for subcategories 1-10 will use the hierarchy presented in Figure 3. First products are segmented by technicity to define the relevant tests based on the product's construction. The next level will be the intended end use (sporting or non-sporting application). This will further refine the test protocol set by the first

segmentation by defining weighting factors for the tests based on intended end use. This provides for a maximum of four different test protocols for each of the apparel subcategories, though there may be overlap between protocols, where there is the same test and thresholds for two different segments, or where two segments such as sport and non-sport have the same testing protocol (e.g. woven t-shirts).

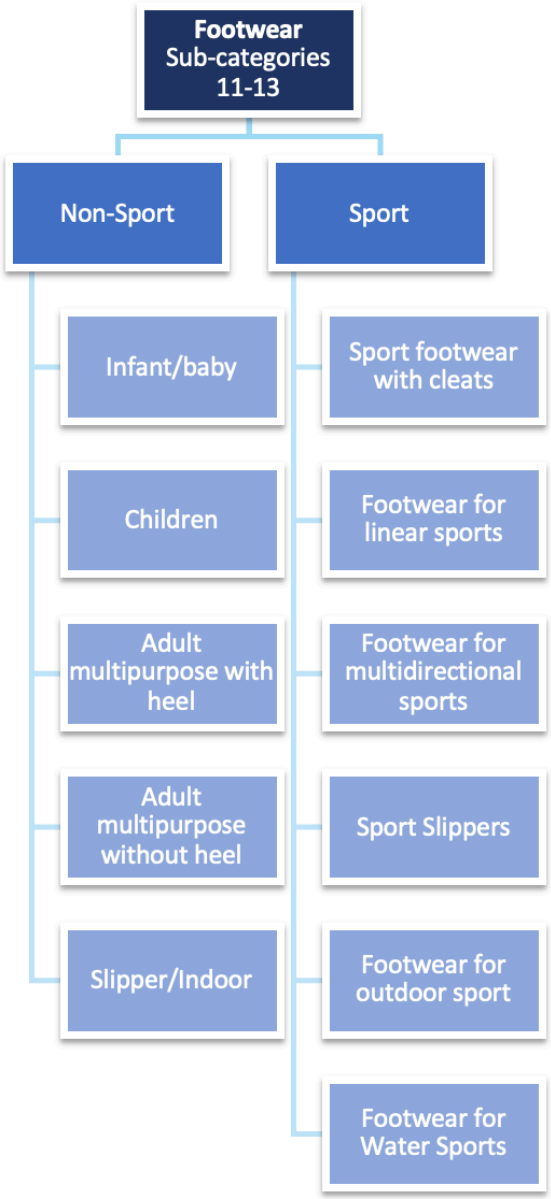
Figure 3 - Flow Chart for Apparel Segmentation




**Footwear (subcategories 11-13)**

The footwear specific subcategories will have similar segmentation to the apparel to ensure the tests selected for a given product most accurately represent factors which impact the duration of service of a product and is presented in Figure 4. The footwear segments will be divided first into either the sport or non-sport segments. The non-sport segment will then be further segmented into one of five classes based on the intended use and design of the product. For sport shoes, the segments will be defined by the type of sport for which the product has been designed.

Figure 4 - Flow Chart for Footwear Segmentation




#### 3.3.3.2 Assessment

Once a product's sub-category and segment have been determined, its relevant physical durability assessment table can be found in Annex V, Part II (based on TS judgment). Unless there is an overriding exemption as outlined below, all tests within the testing table shall be run on each product. All physical durability tests need to be conducted in an ISO 17025 accredited lab. The results of each test shall be recorded, and a score assigned for the test based on the testing thresholds listed in the relevant

product table. All tests will be scored using one of four threshold levels as shown in Table 7, unless otherwise stated in an individual test table.

Table 7 - Thresholds and Test Points

| Threshold | Test Points |
|---|---|
| Below Basic | 0 |
| Basic | 5 |
| Moderate | 10 |
| Aspirational | 15 |

Each test has an individually assigned weighting. For subcategories 1-9 there is also a differentiation between critical and non-critical tests that must be considered. This is explained in detail in Section 3.3.3.3.

**Not Applicable, Not Possible and Not Conducted Tests**

There will be cases where tests for a product cannot be completed. The reason a test cannot be completed for a product shall determine how that test is incorporated into the product score. Each test not completed shall be placed in one of the three categories below, and the justification shall be verified during the validation of the results.

**Not Applicable**

Tests are deemed “not applicable” if the product does not have the specific attribute being tested (e.g. the testing table calls for a zipper failure test, but the product does not have a zipper). “Not applicable” tests shall then be omitted from the final calculation of product score.

**Not Possible**

Tests are deemed “not possible” when the ability to perform a given test on a given product is not possible due to physical limitations of either the product or the testing apparatus. A complete explanation shall be provided to justify when a test has been deemed not possible for a specific product. “Not possible” tests shall then be omitted from the final calculation of the product score. An example of an acceptable justification for a “not possible” test would be the case of a product with a material that has a finish which renders a specific test impossible or irrelevant. An example of this would be an applied finish such as PU coating which would make a pilling test

irrelevant. An example of an unacceptable justification would be claiming that a test is “not possible” because to get a test sample would require destroying the product.

**Not Conducted**

Tests which have not been performed, but which do not fall into either previous category shall be deemed as “not conducted.” “Not conducted” tests shall receive a test result of below basic and shall be included in the final calculation of the product durability score.

**Exemptions**

The durability tables listed in Annex V do not apply to genuine fur or genuine leather apparel products, to menstrual underwear and to small series. The IDM for these products shall therefore equal 1. For small series, durability testing is optional.

**Additional Functionalities**

Annex V, Part III outlines additional functionalities for which additional tests shall be conducted, on products for which the relevant functionality is claimed as an attribute the product has. Examples include apparel insulation or footwear waterproofness. These additional functionalities tests shall be included in the final product score in addition to the tests from the tables in Annex V, Part II.

#### 3.3.3.3 Scoring

**Criticality and End of Life Categories for apparel products (subcategories 1 to 9)**

The “End of Life Category” column included in Annex V, Tables 5 to 36 describes the general aspect of the product which is being assessed by the tests in that category. For example, t-shirts can be discarded due to product deformation, issues with fabric strength or fabric aspect damage, seam aspect damage, accessories aspect damage or colour damage. The “criticality” of a test within an end-of-life category indicates the primary importance of that test for assessing the overall performance of the product to that end-of-life category. If a product scores below basic on a critical test, then the product will receive below basic scores for all other tests within the same end of life

category. For example, in the “fabric aspect damage” end of life category for t-shirts, three tests need to be conducted, but only the “product aspect: holes or broken yarn” test is actually critical.

One exception to this is the case of a criticality of “2 of 3 needed.” In this case 2 of the 3 tests in the given category must score basic or above for the specific test results to be considered to determine the product performance. If 2 of the tests in this category score below basic, then all tests within the category shall be scored as below basic. If only one of the tests in the category scores below basic, then all tests shall be included with their weighted individual test scores in the total product score.

**Weighting and Product Score**

Each test has an associated weighting within each table, which indicates the weight of the individual test result in the total product score. The individual weighting multiplied by the individual test score gives the weighted individual test score, as described in Equation 3.

$$Weighted\ Individual\ Test\ Score = Individual\ Test\ Score\ \times Test\ Weighting$$

Equation 3 - Weighted Individual Test Score Equation

The product score is the sum of all weighted individual test scores over the total weighting for the product, as described in Equation 4. The Intrinsic Durability Product Score will be between 0 and 15.

$$Intrinsic\ Durability\ Product\ Score\ (IDPS) = \frac{Sum\ of\ all\ Weighted\ Individual\ Test\ Scores}{Total\ Product\ Weighting}$$

Equation 4 - Product Score

**Intrinsic Durability Product Score to Intrinsic Durability Multiplier Equation**

All products will receive an Intrinsic Durability Multiplier (IDM) based on their Intrinsic Durability Product Score (IDPS). Based on the limited available knowledge on the extent of impact product durability can have on product lifetime it was determined that the product lifetime duration of service should not have a disproportionate impact on the per use impact of a product. The range of IDMs therefore goes from 0.67 to 1.45, which translates up to a 50% higher environmental impact per use for a product with

low durability and up to a 30% lower environmental impact per use for a product with high durability (TS judgement). A lower IDPS will mean a lower IDM and a higher IDPS will mean a higher IDM. The IDM will be used to determine the total number of uses of a product over its lifetime. Products with an IDPS below 2.5 will all receive the lowest IDM of 0.67. Products with an IDPS between 2.5 to 15.0 will receive an IDM according to Equation 5, where x is the IDPS and y is the IDM. The coefficients in Equation 5 lead to a linear increase of the IDM between the minimum (0.67) and maximum (1.45) scores.

$$if\ IDPS \leq 2.5, IDM = 0.67$$
$$if\ IDPS > 2.5, IDM = 0.514 + (0.0624 \times IDPS)$$

Equation 5 - Conversion of Product Score to Lifetime Modifier

Examples of the calculation of the IDPS and IDM of fictional products is provided in Part V in ANNEX V – Detailed requirements regarding intrinsic durability.

### 3.3.4 Repair/refurbish

The lifetime of a product can be extended through repair to maintain it in “good condition”.

Two aspects are taken into account to define a repairability multiplier (RM, see Calculation of the Repairability Multiplier ):

- The intrinsic repairability of an apparel or footwear product, as in the capacity of a product to be repaired, independently of whether or not the repair will actually happen (promoting ecodesign practices). This includes two criteria: the Repair cost ratio (RC) and Spare Parts (SP);
- The external repairability, as in the existence of an after-sales service for repair, and its quality. This includes two criteria: Repair Service (RS) and “Right to Repair” Communication (RRC).

#### 3.3.4.1 Repair cost ratio (RC)

The cost of repair is the key driver in repairability (ADEME, 2022). The Repair Cost Ratio evaluates the cost of repair, using the EU average repair cost of the product sub-

category and the average EU product selling price. Customer mailing fees shall be included if the customer is responsible for paying for shipping back to the repair facility. The $RC_{EU}$ criterion shall be calculated according to Equation 6, unless the user of the PEFCR chooses to calculate a company sales-specific RC ($RC_{CSS}$), in which case Equation 9 shall be used.

$$RC_{EU} = \frac{AverageRepairCost_{EU}}{ProductSellingPrice_{EU}} = \frac{AverageRepairCost_{FR} * PPP_{EU}}{ProductSellingPrice_{EU} * PPP_{FR}} = \frac{AverageRepairCost_{FR}}{ProductSellingPrice_{EU} * PPP_{FR}}$$

Equation 6

with the following parameters:

**$ProductSellingPrice_{EU}$:** the average selling price for the product in the EU market based on EU volumes of the product sub-category sold during the most recent annual administration period, which shall be calculated according to Equation 7.

**$ProductSellingPrice_i$:** the selling price for the product in country i, based on volumes of the product sub-category sold in country i during the most recent annual administration period

**$AverageRepairCost_{EU}$:** the average repair cost of the relevant sub-category shall be used, calculated from the average repair cost in France (ADEME, 2022) and using the Purchasing Power Parity (PPP, Eurostat[10]). Default data from Table 8 based on Equation 8 shall be used.

**$AverageRepairCost_{FR}$:** the average repair cost for the product sub-category in France

**$PPP_{EU}$:** the Purchasing Power Parity of EU relative to the EU from the latest version of the Eurostat database[10]. This value, being the reference, will always be 1.

**$PPP_{FR}$:** the Purchasing Power Parity of France relative to the EU from the closest year compared to the year used for the product selling price in the the Eurostat database[10].. In Eurostat 2022, this value is 1.07128.

**$PPP_i$:** the Purchasing Power Parity of country i relative to the EU from the latest version of the Eurostat database[10].

**$W_i$**: the weight of country i in the company's EU product sales volumes of the product sub- category from the most recent annual administration period

[10] https://ec.europa.eu/eurostat/web/purchasing-power-parities/database. An ECAS account is required to access the Eurostat database

$$ProductSellingPrice_{EU} = \sum_{i=1}^{n} \frac{ProductSellingPrice_i * PPP_{EU} * W_i}{PPP_i}$$

$$= \sum_{i=1}^{n} \frac{ProductSellingPrice_i * W_i}{PPP_i}$$

Equation 7

$$AverageRepairCost_{EU} = AverageRepairCost_{FR} * \frac{PPP_{EU}}{PPP_{FR}} = \frac{AverageRepairCost_{FR}}{PPP_{FR}}$$

Equation 8

Table 8 - Average repair cost per product sub-category

| Product sub-category | Average repair cost in France[11] $AverageRepairCost_{FR}$ | Average repair cost in EU $AverageRepairCost_{EU}$ |
|---|---|---|
| 1. T-shirts | € 10.00 | € 9.33 |
| 2. Shirts and blouses | € 10.00 | € 9.33 |
| 3. Sweaters and midlayers | € 15.00 | € 14.00 |
| 4. Jackets and coats | € 31.00 | € 28.94 |
| 5. Pants and shorts | € 14.00 | € 13.07 |
| 6. Dresses, skirts and jumpsuits | € 9.00 | € 8.40 |
| 7. Leggings, stockings, tights and socks | € 9.00 | € 8.40 |
| 8. Underwear | € 9.00 | € 8.40 |
| 9. Swimwear | € 9.00 | € 8.40 |
| 10. Apparel accessories | € 9.00 | € 8.40 |
| 11. Open-toed shoes | € 21.00 | € 19.60 |
| 12. Closed-toed shoes | € 21.00 | € 19.60 |
| 13. Boots | € 21.00 | € 19.60 |

For example, a company selling a t-shirt on the EU market at an average selling price of 35 EUR will have an $RC_{EU}$ of

[11] Source : ADEME, 2021

$$RC_{EU} = \frac{AverageRepairCost_{EU}}{ProductSellingPrice_{EU}} = \frac{9.33\ EUR}{35\ EUR} = 27\%$$

The calculation of a company sales-specific RC is specified in Equation 9.

$$RC_{CSS} = \sum_{i=1}^{n} \frac{RepairCost_i * W_i}{ProductSellingPrice_i}$$

Equation 9

with the following parameters:

**RepairCost$_i$** : the repair cost for the product sub-category in country i. This shall be calculated by using a weighted average of product sales volumes and PPPs according to Equation 10 and default data from Table 8.

**ProductSellingPrice$_i$:** the selling price for the product in country i, based on volumes of the product sub-category sold in country i during the most recent annual administration period.

**W$_i$ (%):** the share of country i in the company's EU product sales volumes of the product sub-category from the most recent annual administration period

**n:** the number of EU countries in which the company sells the product sub-category

$$RepairCost_i = \frac{AverageRepairCost_{FR} * PPP_i}{PPP_{FR}}$$

Equation 10

with the following parameters:

**AverageRepairCost$_{FR}$:** the average repair cost for the product sub-category in France

**PPP$_i$:** the Purchasing Power Parity of country i relative to the EU from the latest version of the Eurostat database[12].

**PPP$_{FR}$:** the Purchasing Power Parity of France relative to the EU from the closest year compared to the year used for the product selling price in the Eurostat database[12]. In Eurostat 2022, this value is 1.07128.

For example, a company selling a t-shirt with 70% of the sales volume in France, 20% in Spain and 10% in Belgium at 35 EUR in all 3 countries will have an $RC_{CSS}$ of

[12] https://ec.europa.eu/eurostat/web/purchasing-power-parities/database. An ECAS account is required to access the Eurostat database

$$RC_{CSS} = \sum_{i=1}^{n} \frac{RepairCost_i * W_i}{ProductSellingPrice_i} = \frac{AverageRepairCost_{FR} * W_{FR} * PPP_{FR}}{ProductSellingPrice_{FR} * PPP_{FR}}$$
$$+ \frac{AverageRepairCost_{FR} * W_{ES} * PPP_{ES}}{ProductSellingPrice_{ES} * PPP_{ES}}$$
$$+ \frac{AverageRepairCost_{FR} * W_{BE} * PPP_{BE}}{ProductSellingPrice_{BE} * PPP_{FR}}$$
$$= \frac{10\ EUR * 0.7 * 1.07128}{35\ EUR * 1.07128} + \frac{10\ EUR * 0.2 * 0.97606}{35\ EUR * 1.07128}$$
$$+ \frac{10\ EUR * 0.1 * 1.17693}{35\ EUR * 1.07128} = 20\% + 5\% + 3\% = 28\%$$

The RC criterion is used in scoring in 2 ways:

1. Pass/Fail factor:
    - The RC passes if RC ≤ 33[13] %. The product is considered as repairable and the repairability multiplier will be > 1.
    - The RC fails if RC > 33%. The product is not considered as repairable and the repairability multiplier will be 1.
2. RC is used in scoring of RM as a multiplying factor with a linear distribution for 33% ≥ RC ≥ 10% (see Calculation of the Repairability Multiplier ).

#### 3.3.4.2 Spare Parts (SP)

Providing spare parts is useful for repair and demonstrates an effort from brands. The SP criteria is defined as providing technical or aesthetic equivalent to a missing or broken spare part. A spare part includes all trims (buttons, zippers, belt buckles etc.), threads, and/or the spare parts that are obviously needed to repair the product. The SP criterion has no time limit.

The SP criterion is used in scoring in the following way:

- If available in all locations (in all physical **and** all virtual points of sale) or the product does not need spare parts, SP = 1
- If no spare parts are available, SP = 0

[13] 33% is reported to be the psychological threshold for above which product replacement is preferred to repair (ADEME, 2022).

#### 3.3.4.3 Repair Service (RS)

Providing or offering repair is a big driver to real repair and demonstrates a strong brand effort. The RS criterion is defined as making repair services and/or aftersales services geographically and economically accessible. The basic list of repairs that shall be provided (brands may provide more repair services than the basic list of repairs) are the ones listed in Table 9 and represent around 80% of repairs done on the market (Refashion 2023). Point(s) of deposit should be available in both physical and virtual points of sale, at no extra cost for basic repairs (see list in the Repair column in Table 9) relevant for the product.

The RS criterion is used in scoring in the following way:

- If available in **all** locations (in all physical **and** all virtual points of sale) and **free** for the repairs mentioned in Table 9, RS = 1
- If available in **all** locations (in all physical **and** all virtual points of sale), RS = 0.5
- If not, RS = 0

Table 9 - Repairs to be provided as a service

| Category | Repair | Repair communication allowing repair by consumer (Y/N) |
|---|---|---|
| **Apparel** | Replacement of shirt collar or cuff | N |
| | Belt-loop repair | N |
| | Changing the lining | N |
| | Installation of knee pads, elbow pads | Y |
| | Fixing loose or missing buttons | Y |
| | Pocket lining replacement | N |
| | Repairing undone seam, fallen hem | Y |
| | Tear repair | Y |
| | Tear repair, snag, moth hole | Y |
| | Zip change | N |
| **Footwear** | Forefoot sole part replacement | N |
| | Complete resoling of the shoe | N |
| | Repairing undone stitching | N |
| | Bonbout replacement | N |
| | Reattach a heel | N |
| | Eyelet replacement | N |

| Category | Repair | Repair communication allowing repair by consumer (Y/N) |
|---|---|---|
| | Lining repair (heel cover, interior, insock) | N |
| | Cleaning of sneakers (beautification/restoration) | Y |
| | Heel replacement | N |
| | Zipper replacement | N |

#### 3.3.4.4 "Right to Repair" Communication (RRC)

The availability of information on repair is one of the main drivers for repairability. Aligned with the EU directive "Right to Repair"[14], the RRC criterion includes information on repair during the sale and throughout the garment life, which shall include the following:

- Conformity warranty information according to EU regulations (see https://europa.eu/youreurope/business/dealing-with-customers/consumer-contracts-guarantees/consumer-guarantees/index_en.htm for more information);
- Repair documentation (generic). Table 9 provides the list of repairs that shall be covered by the repair documentation provided by the brand together with the product at the point of sale. For all the repairs relevant to the product:
    - If the Repair communication column = N : the repair documentation shall indicate that repairs shall be done using professional repair services
    - If the Repair communication column = Y : the brand shall decide to either share detailed reparability information for the consumer to be able to conduct the repair successfully themself, OR the communication shall indicate that repairs can be done using professional repair services provided by the brand
- Repair services & Spare parts communication if relevant;
- A "repair map" - an online/offline guide to where repairs can be made, covering either the location of repair services provided by the brand **OR** a map of all existing repair shops the product can be repaired at.

[14] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52023PC0155

The RRC criterion is used in scoring in the following way :

- If all the above conditions are achieved, RRC = 1
- If not, RRC = 0

The brand may decide on the format of the repair documentation, but it shall contain as a minimum:

- The list of repairs related to the product (see Table 9). Repair documentation shall be provided for all the relevant repairs;
- Online/Offline “repair map” (mapping for repair location) OR communication on brand repair service;
- The availability and accessibility of the spare parts that are obviously needed to repair the product;
- The resources needed for the repair:
    a) Equipment needed;
    b) Other useful information: tutorials, link to the spare parts stores, etc.

#### 3.3.4.5 Calculation of the Repairability Multiplier

The calculation of the repairability multiplier (RM) reflects the biggest driver for repair, i.e. the Repair Cost Ratio, and aims to drive brand engagement in repairability.

The RM is calculated as follows (TS expertise):

- If RC > 33% then $RM = 1$
- If 33% ≥ RC ≥ 10% then $RM = 1 + \left( \left( \frac{-RC}{0.23} + \frac{0.33}{0.23} \right) * (0{,}5 * RS + 0{,}3 * RRC + 0{,}2 * SP) \right) * 0.15$
- If RC < 10% then $RM = 1 + \left(1 * (0{,}5 * RS + 0{,}3 * RRC + 0{,}2 * SP)\right) * 0.15$

With the following parameters:

**RM:** the Repairability Multiplier, used in the calculation of the specific duration of service in Equation 1. Its minimum value is 1 and its maximum value 1.15.

**RC:** the Repair Cost ratio as defined in Section 3.3.4.1. RC is calculated using Equation 8, unless the user of the PEFCR chooses to calculate a company sales-specific RC, in which case Equation 9 shall be used.

**RS:** the Repair Services criterion as defined in Section 3.3.4.3. If repair services are available in all locations (in all physical and all virtual points of sale) and free for the repairs mentioned in Table 9, RS = 1. If they are available in all locations (in all physical and all virtual points of sale) but not free, RS = 0.5, otherwise RS = 0.

**RRC:** the Right to Repair Communication as defined in Section 3.3.4.4. RRC = 1 if all the conditions listed in Section 3.3.4.4 are achieved. Otherwise RRC = 0.

**SP:** the Spare Parts criterion as defined in Section 3.3.4.2. SP = 1 if spare parts are available in all locations (in all physical and all virtual points of sale) or the product does not need spare parts, otherwise SP = 0.

For example, if a company has a RC of 27%, has repair services available in all locations (in all physical and all virtual points of sale) and offers repairs for free for the categories in Table 9 (RS = 1), fulfils all the criteria for the “Right to Repair” communication (RRC = 1), and spare parts are available in all locations (in all physical and all virtual points of sale) or the product does not need spare parts (SP = 1), then the repairability multiplier would be:

$$RM = 1 + \left( \left( \frac{-0.27}{0.23} + \frac{0.33}{0.23} \right) * (0{,}5 * 1 + 0{,}3 * 1 + 0{,}2 * 1) \right) * 0.15 = 1.04$$

## 3.4 System boundaries

The following life cycle stages and processes shall be included in the system boundary: the entire life cycle (from cradle to grave) of apparel and footwear products including the raw material production (including packaging production for intermediary and final products), manufacturing, distribution, use and end-of-life life cycle stages. The system boundaries are shown in Figure 5 for apparel and Figure 6 for footwear. The main processes for each life cycle stage are also indicated below.

Figure 5 - System boundary diagram for apparel

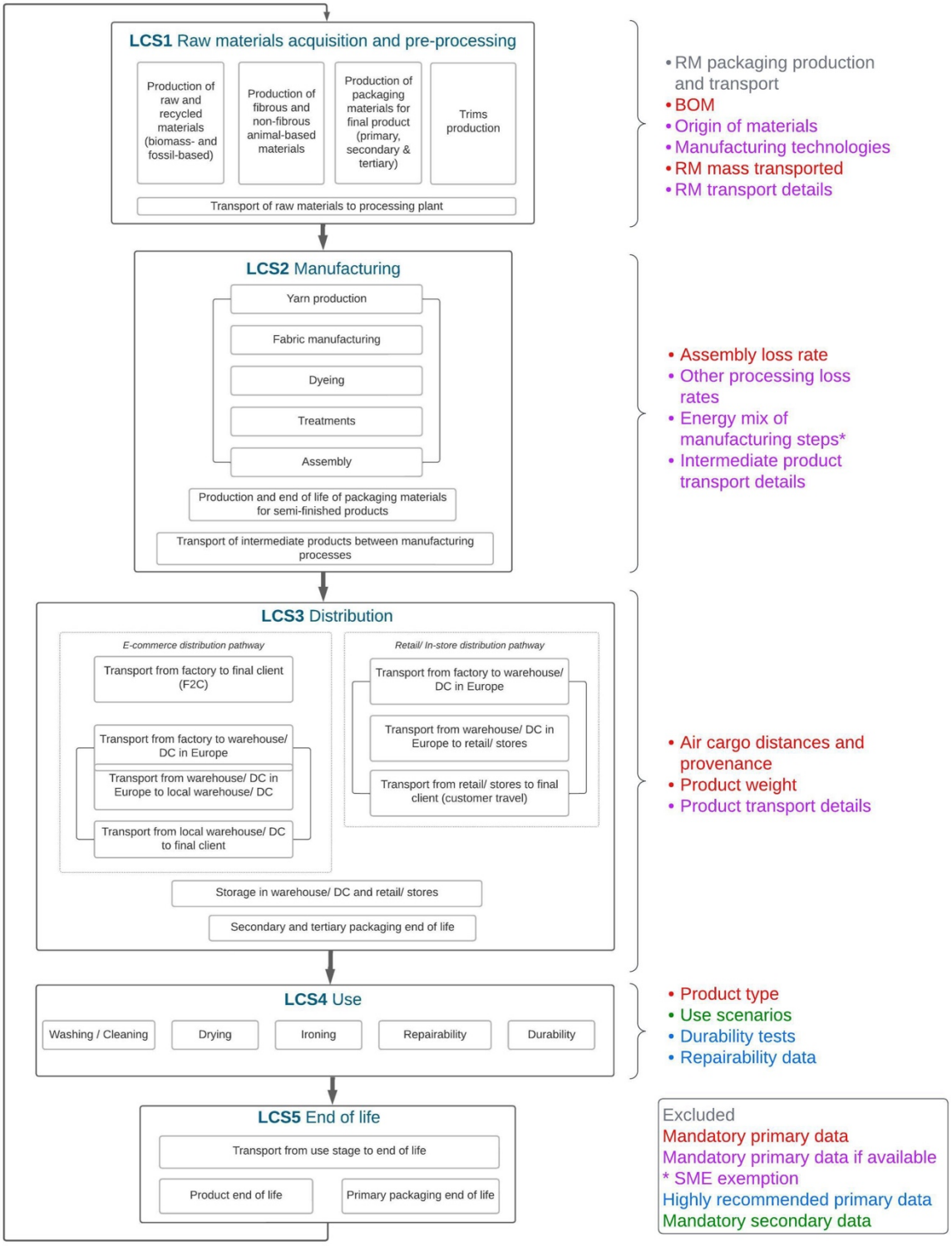


Figure 6 - System boundary diagram for footwear

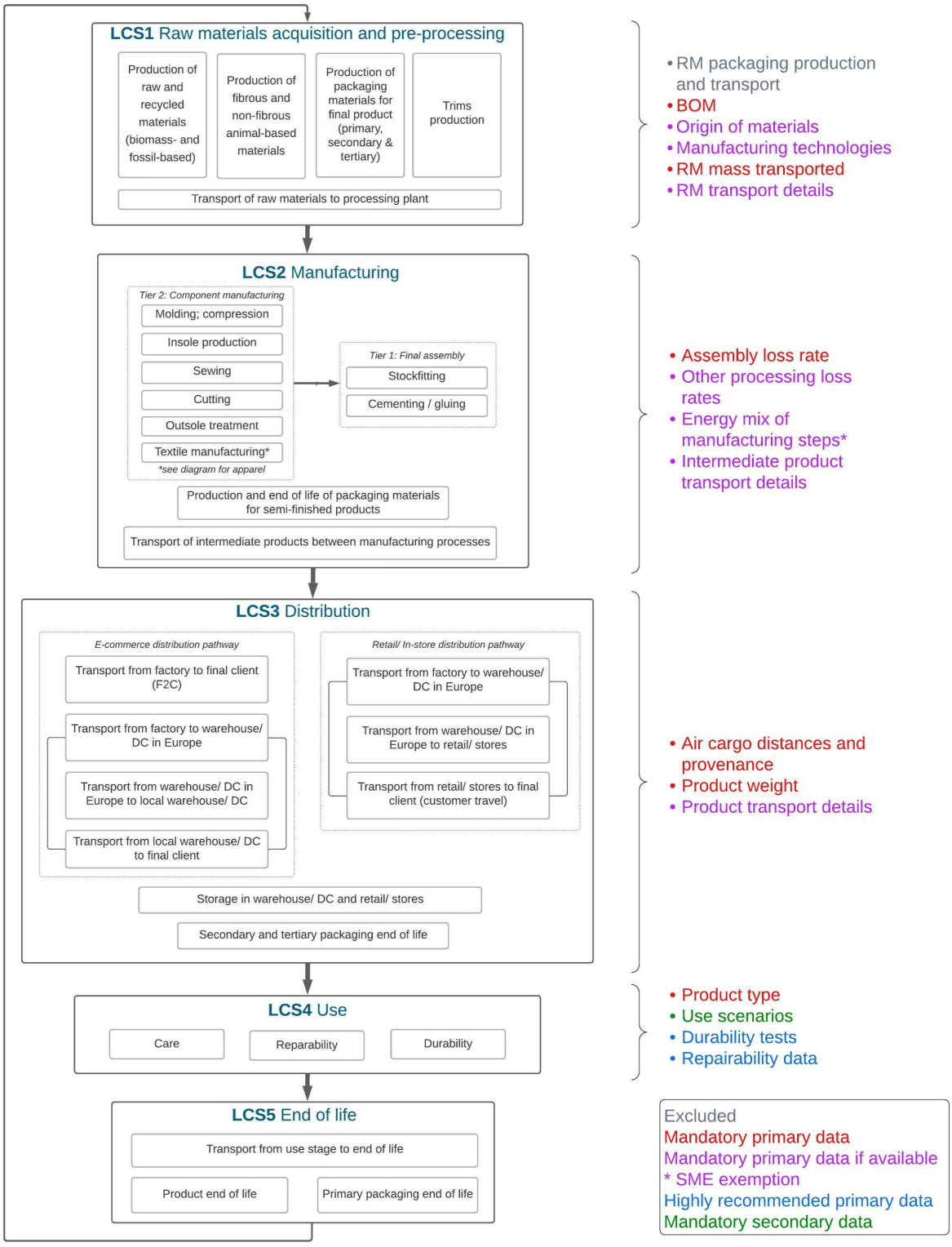


Table 10 - Processes included per life cycle stage (non-exhaustive list)

| Life cycle stage | Short description of the processes included (non-exhaustive list) |
|---|---|
| LCS1<br>Raw materials acquisition and pre-processing | ● Production or extraction of raw textile, rubber, and plastic materials; fibrous and non-fibrous animal-based materials (including leather materials, tanning and finishing); packaging materials, hangtag and trims<br>● Transport of raw material transport to manufacturing plant (see Section 6.1.6) |
| LCS2<br>Manufacturing | Apparel and footwear<br>● Scouring (e.g. wool, cotton, linen)<br>● Combing, carding, hackling<br>● Production of yarn through spinning (production of yarn from staple fibres) and melt / solution spinning (production of filament)<br>● Production of knitted fabric (e.g. knitting circular, knitting flat)<br>● Production of woven fabric<br>● Production of seamless fabric<br>● Production of padded filling (e.g. non-woven fabric, tufted fabric, felted fabric)<br>● Dyeing: Bleaching, dyeing and printing processes<br>● Treatments, both wet and dry (includes scouring, pre-dye treatments, finishing, chemical treatments (e.g. moisture management and water repellence), coating, lamination, heat treatments (e.g. curing, drying, heat setting, calendaring), mechanical treatments (e.g. raising, brushing))<br>● Assembly (includes sewing)<br>● Any other manufacturing process<br>● Transport of intermediate products between manufacturing processes see Section 6.1.6)<br>● Production of semi-finished and intermediate products packaging<br>● Recycling, incineration (with and without energy recovery) and landfilling of the semi-finished and intermediate products packaging and manufacturing losses and leftovers<br><br>Footwear only:<br>● Compound forming<br>● Die-cutting<br>● In-sole production and assembly<br>● Lasting & delasting<br>● Out-sole treatment (e.g., vulcanisation)<br>● Sewing, fusing<br>● Stockfitting |
| LCS3<br>Distribution | E-commerce:<br>● Transport from factory to the final client (factory to consumer)<br>● Transport from factory to warehouse/ distribution centre located in Europe<br>● Transport from a warehouse/ distribution centre located in Europe to a local warehouse/ distribution centre<br>● Transport from local warehouse/ distribution centre to final client<br>● Transport of distribution losses and unsold consumer products<br>● Recycling, incineration (with and without energy recovery) and landfilling of the secondary, tertiary packaging, unsold consumer products and distribution losses<br>Retail/ in-store:<br>● Transport from factory to warehouse/ distribution centre located in Europe<br>● Transport from warehouse/ distribution centre located in Europe to retail/ stores<br>● Transport from retail/ stores to final client (consumer travel)<br>● Transport of distribution losses and unsold consumer products |

| | |
|---|---|
| | ● Recycling, incineration (with and without energy recovery) and landfilling of the secondary, tertiary packaging, unsold consumer products and distribution losses |
| LCS4<br>Use | Apparel<br>● Washing / cleaning<br>● Drying<br>● Ironing<br>Footwear<br>● Care<br>Both<br>● Repair |
| LCS5<br>End of life | ● Transportation from user to collection point<br>● Transportation from collection point to sorting point (incl. transport for reuse inside and outside of Europe)<br>● Transportation from sorting point to recycling<br>● Transportation from user to disposal<br>● Recycling, incineration (with and without energy recovery) and landfilling of the products as well as of primary packaging |

Hangers are exceptionally given away to consumers (expert judgment). They are thus considered as capital goods and are excluded from the study.

Temporary displays are very seldom recommended by apparel and footwear brands (expert judgement). As such, they are excluded from the system boundaries of apparel and footwear products but shall be included in the footprint of any retailer deciding to use them. In this case, the type of materials and number of temporary displays shall be determined, brought back to a single product, and be treated as secondary packaging.

According to this PEFCR, the following processes may be excluded based on the cut-off rule: production and distribution of packaging for raw materials, based on the results of the PEF-RP study. More information is available in the PEF-RP study itself.

No additional cut-off is allowed.

Each PEF study done in accordance with this PEFCR shall provide in the PEF study a diagram indicating the activities falling in situation 1, 2 or 3 of the data needs matrix (see Section 5.4).

## 3.5 List of EF impact categories

Each PEF study carried out in compliance with this PEFCR shall calculate the PEF-profile including all EF impact categories listed in the Table below. As climate change was identified as a most-relevant impact category, and the sub-categories 'Climate change - biogenic' and 'Climate change - land use and land transformation' contribute more than 5% each to the total impact of some RPs, these sub-categories shall be reported separately.

Table 11 - Impact categories for the PEF profile

| EF impact category | Impact indicator | Unit | Characterization model | Robust-ness |
|---|---|---|---|---|
| Climate change, total[15] | Global Warming Potential (GWP100) | kg $CO_2$-eq | Bern model - Global warming potential (GWP) over a 100-year time horizon based on IPCC 2021 (Forster et al., 2021). | I |
| Ozone depletion | Ozone Depletion Potential (ODP) | kg CFC-11-eq | EDIP model based on the ODPs of the World Meteorological Organisation (WMO) over an infinite time horizon (WMO 2014 + integrations) | I |
| Human toxicity, cancer | Comparative Toxic Unit for humans (CTUh) | CTUh | Based on USEtox2.1 model (Fantke et al. 2017), adapted as in Saouter et al., 2018 | III |
| Human toxicity, non-cancer | Comparative Toxic Unit for humans (CTUh) | CTUh | Based on USEtox2.1 model (Fantke et al. 2017), adapted as in Saouter et al., 2018 | III |
| Particulate matter | Impact on human health | disease incidence | PM model (Fantke et al., 2016 in UNEP 2016) | I |
| Ionising radiation, human health | Human exposure efficiency relative to U235 | kBq $U^{235}$ -eq | Human health effect model as developed by Dreicer et al., 1995 (Frischknecht et al, 2000) | II |
| Photochemical ozone formation, human health | Tropospheric ozone concentration increase | kg NMVOC -eq | LOTOS-EUROS model (Van Zelm et al, 2008) as applied in ReCiPe 2008 | II |
| Acidification | Accumulated Exceedance (AE) | mol $H^+$ -eq | Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008) | II |
| Eutrophication, terrestrial | Accumulated Exceedance (AE) | mol N -eq | Accumulated Exceedance (Seppälä et al., 2006, Posch et al, 2008) | II |

[15] *The indicator "Climate Change, total" is a combination of three sub-indicators: Climate change – Change fossil; Climate change –Change biogenic; Climate change – land use and land use change. The sub-indicators are further described in section 4.4.10 of Annex I. The sub-categories 'Climate change –fossil', 'Climate change – biogenic' and 'Climate change - land use and land use change' shall be reported separately, if they show a contribution of more than 5% each to the total score of climate change.*

| EF impact category | Impact indicator | Unit | Characterization model | Robust-ness |
|---|---|---|---|---|
| Eutrophication, freshwater | Fraction of nutrients reaching freshwater end compartment (P) | kg P -eq | EUTREND model (Struijs et al, 2009) as applied in ReCiPe 2008 | II |
| Eutrophication, marine | Fraction of nutrients reaching marine end compartment (N) | kg N -eq | EUTREND model (Struijs et al, 2009) as applied in ReCiPe 2008 | II |
| Ecotoxicity, freshwater | Comparative Toxic Unit for ecosystems (CTUe) | CTUe | Based on USEtox2.1 model (Fantke et al. 2017), adapted as in Saouter et al., 2018 | III |
| Land use (occupation and transformation) | Soil quality index (dimensionless)[16] ● | Dimensionless (pt) | Soil quality index based on LANCA model (De Laurentiis et al. 2019) and on the LANCA CF version 2.5 (Horn and Maier, 2018) | III |
| Water use | User deprivation potential (deprivation- weighted consumption) | $m^3$ world -eq | Available WAter REmaining (AWARE) model (Boulay et al., 2018; UNEP 2016) | III |
| Resource use[17], minerals and metals | Abiotic resource depletion (ADP ultimate reserves) | kg Sb -eq | van Oers et al., 2002 as in CML 2002 method, v.4.8 | III |
| Resource use, fossils | biotic resource depletion – fossil fuels (ADP-fossil) | MJ | van Oers et al., 2002 as in CML 2002 method, v.4.8 | III |

The full list of normalisation factors and weighting factors are available in ANNEX I – List of EF normalisation and weighting factors. The full list of characterization factors is available at this link http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml. The EF reference package 3.1 shall be used.

## 3.6 Additional technical information

| Note | No additional technical information currently needs to be reported. |
|---|---|

[16] *This index is the result of the aggregation, performed by JRC, of 4 indicators (biotic production, erosion resistance, mechanical filtration, and groundwater replenishment) provided by the LANCA model for assessing impacts due to land use as reported in De Laurentiis et al, 2019.*

[17] *The results of this impact category shall be interpreted with caution, because the results of ADP after normalization may be overestimated. The European Commission intends to develop a new method moving from depletion to dissipation model to better quantify the potential for conservation of resources.*

## 3.7 Additional environmental information

### 3.7.1 General information

Biodiversity is considered as relevant for each product sub-category in scope of the PEFCR based on TS expert judgement. To assess and report impacts on biodiversity, an organic certification system for natural fibres may be used as a proxy. The PEFCR applicant shall report whether any of the materials are certified as organic and report the total mass percentage of the product that is certified organic.

Additional environmental information may include the following (non-exhaustive list):

- Corporate level - Information regarding the company's work with environmental responsibility, such as which initiatives the company has joined (e.g. reporting to CDP), or data about specific environmental characteristics of the product;
- Product level – Information on any sustainability programs followed at product or production level, and share or product or production covered (e.g., percentage of cardboard from a certified source or percentage of textiles from certified labels (e.g. OEKO-TEX® MADE IN GREEN or ZDHC's MRSL compliance)).

To substantiate the above information, reference should be made to the Directive on Empowering Consumers for the Green Transition (ECGT), adopted on 20 February 2024. This directive complements other EU legislation, most notably the Green Claims Directive, proposed in March 2023 and not yet adopted.

Disclosed information about a company's efforts in environmental responsibility or sustainability programs, both at the corporate or product/production level, may qualify as environmental claims. Environmental claims are defined as "any non-mandatory message or representation (including text, images, or symbols) in commercial communication, suggesting that a product or trader positively impacts the environment, is less harmful, or has improved its environmental impact over time" (European Parliament and Council of the European Union, 2005).

Under the Directives, this information will have to be substantiated and verified within commercial business-to-consumer practices.

The directives will also set requirements for environmental labelling schemes, such as certification programs that ensure a product, process, or company meets environmental label standards. These schemes will have to be verified by a third party either through an approved certification scheme or recognized public authority and are subject to regular reviews. This applies to schemes both within and outside the EU, including those already established (European Commission, 2023).

| Note | This general additional environmental information does not impact calculations. This list will be updated regularly as required. Until the Green Claims Directive is fully approved, all supplementary information, including participation in certification schemes, should be substantiated with evidence. A certification document that verifies the acquired certifications shall be disclosed during the study review. |
|---|---|

### 3.7.2 Fibre fragment impact calculation

Fibre fragment leakage is often associated with the production, use and end-of-life stages of apparel and footwear products. Although scientific research is still ongoing to fully understand and model the impact of fibre fragments coming from apparel and footwear products on all environmental compartments, a first estimation of the impact of fibre fragments coming from the product's care cycle on the marine biota and sediments can be calculated and shall be included in any PEF study.

The release of fibre fragments into the marine environment during washing applies only to textile products as defined in the EU Textiles Labelling Regulation in the case of apparel and for footwear labelled as textiles in EU Footwear Labelling Directive. In general, genuine leather and genuine fur articles will not be washed, dried, ironed or steamed (see Section 6.4.1) and will therefore not have fragment release related to these processes.

| Note | This initial fibre fragment impact assessment is limited and embeds a high uncertainty (both from the inventory data and the modelling used). It is recommended the approach is updated as soon as more information is available to: |
|---|---|

- Cover the entire lifecycle of apparel and footwear products, including production of raw materials, and shedding during use (wear) and end-of-life.
- Include the impact of fibre fragments on the entire marine compartment, as well as on any other relevant environmental compartment such as freshwater, air and land.

#### 3.7.2.1 Fibre fragment inventory for one care cycle

First, a fibre fragment inventory for the product's care cycle needs to be calculated. For each textile raw material used (based on the product's BOM and the associated manufacturing processes (e.g. circular or flat knitting, weaving, etc.)), secondary data shall be used, unless primary data is available. The secondary data proxies used for fibre fragment inventory calculations shall be taken from TMC's most recent Microfibre Data Portal Annual Insights[18]. The most representative data proxies shall be selected based on the BOM of the product being assessed, and a BOM weighted calculation approach shall be applied in the case of a product with mixed fibre composition. In case primary data is used, it shall be obtained using the TMC (The Microfibre Consortium Test Method: quantification of fibre release from fabrics during domestic laundering, Version 1.2), ISO 4484:1 or AATCC TM212 test methods. When using primary data, a test shall be conducted for each fabric in the product. Trims, electronic parts, metals, and footwear components shall be excluded from the inventory.

The fibre fragment inventory for each raw material is obtained using Equation 11:

$$FFLoss_i = \frac{Weight_{Product}}{UsesPerCareCycle} * (MaterialShare_i * AvgFFLoss_i)$$

Equation 11

With the following parameters:

**$FFLoss_i$** (g fibre fragment emitted/use): the fibre fragments emitted from raw material $i$ for 1 use

**$Weight_{Product}$** (kg) : weight of the product

[18] https://www.microfibreconsortium.com/resources-1

**UsesPerCareCycle** (use/wash): number of uses of the product prior to a care cycle. Default values from Table 40 shall be used.

**MaterialShare$_i$** (%): share of raw material $i$ according to the Bill of Materials

**AvgFFLoss$_i$** (g fibre fragment emitted/kg of product/wash): the average fibre fragment quantity emitted for 1kg of raw material $i$ and 1 care cycle for the relevant raw material and fabric construction, based on secondary data from TMC's most recent Microfibre Data Portal Annual Insights.

**TotalFFLoss** (g fibre fragment emitted/kg of product/wash): the total fibre fragment quantity emitted for 1kg of raw material $i$ and 1 care cycle, based on primary data using the TMC (The Microfibre Consortium Test Method: quantification of fibre release from fabrics during domestic laundering, Version 1.2), ISO 4484:1 or AATCC TM212 test methods.

When using primary data, Equation 10 shall be used, replacing **AvgFFLoss$_i$** with the total fibre fragment loss **TotalFFLoss**. For primary data from blended fabrics, the fibre fragment loss FFLoss$_i$ shall be allocated to each raw material in the blend according to its material composition MaterialShare$_i$.

#### 3.7.2.2 Fibre fragment impact on marine biota

The impact of the fibre fragments shed during the care cycle shall be calculated based on the inventory following Section 3.7.2.1, using the most relevant characterisation factor from the MarILCA publications (Corella-Puertas, 2023 and Saadi, 2024). The relevant material characterisation factor shall be chosen and if the material is not available, the closest available proxy shall be chosen according to the material selection in Section 3.8.2. The default initial fibre diameter of 10 µm shall be used, unless primary data are used. Both the midpoint (PAF*$m^3$*day/use, representing the ecosystem quality impact based on affected fraction of species) and the endpoint (PDF*m2*year/ use, representing the ecosystem quality damage based on disappeared fraction of species) impacts shall be calculated to evaluate the physical effects on biota from fibre fragment emissions to marine environments.

The fibre fragment inventory of each raw material is multiplied by the characterisation factor of each raw material (or closest proxy) and then summed to obtain the total fibre

fragment impact as per Equation 12 for the midpoint impact and Equation 13 for the endpoint impact.

$$MidpointImpact = \sum_{i=1}^{n} MidpointImpact_i = \sum_{i=1}^{n} \left( \frac{FFLoss_i}{1000} * MidpointCF_i \right)$$

Equation 12

$$EndpointImpact = \sum_{i=1}^{n} EndpointImpact_i = \sum_{i=1}^{n} \left( \frac{FFLoss_i}{1000} * EndpointCF_i \right)$$

Equation 13

With the following parameters:

**$FFLoss_i$** (g fibre fragment emitted/use): see Equation 11

**MidpointImpact** (PAF*$m^3$*day/use): the midpoint impact of the product for 1 use

**n**: number of raw materials in the Bill of Materials

**$MidpointImpact_i$** (PAF*$m^3$*day/use): the midpoint impact of raw material $i$ for 1 use

**$MidpointCF_i$** (PAF*$m^3$*day/ kg fibre fragment emitted): the characterisation factor of the midpoint impact for 1 kg of fibre fragment emitted for raw material $i$, based on MariLCA data[19]. The default initial fibre diameter of 10 µm shall be used, unless primary data are used.

**EndpointImpact** (PDF*$m^2$*year/ use): the endpoint impact of the product for 1 use

**$EnddpointImpact_i$** (PDF*$m^2$*year/use): the endpoint impact of raw material $i$ for 1 use

**$EndpointCF_i$** (PDF*$m^2$*year/ kg fibre fragment emitted): the characterisation factor of the endpoint impact for 1 kg of fibre fragment emitted for raw material $i$, based on MariLCA data[19]. The default initial fibre diameter of 10 µm shall be used, unless primary data are used.

#### 3.7.2.3 Communication of results

To be consistent with the other characterised results shared in a PEF study, the fibre fragment impact shall be shared per use, using the same care cycle information provided in Section 6.4.1. (apparel products) and Section 6.4.4 (footwear products). The PEF report shall include the following results:

[19] Saadi, N; Lavoie, J; Fantke, P; Redondo-Hasselerharm, P; Boulay, A.-M. "Including Impacts of Microplastics in Marine Water and Sediments in Life Cycle Assessment"

- the total midpoint and endpoint fibre fragmentation impact of the product
- the midpoint and endpoint impact for each of the raw materials included in the BoM
- the inventory of fibre fragments released from each raw materials included in the BoM

The following sentence shall be included next to the results:

“This fibre fragment impact embeds a high uncertainty due to the developing nature of the underlying scientific assessment methodology but reflects the best practice and the currently most up to date scientific knowledge on the matter. It is recommended the approach is updated as soon as more information is available to:

- Cover the entire lifecycle of apparel and footwear products, including production of raw materials, and shedding during use (wear) and end-of-life.
- Include the impact of fibre fragments on the entire marine compartment, as well as on any other relevant environmental compartment such as freshwater, air and land.”.

| Note | Due to the uncertainty of the approach, this method shall not be used to substantiate fibre fragment specific claims. |
|---|---|

#### 3.7.2.4 Example calculation

A 170 g circular knitted t-shirt (Weight = 0.17 kg) is composed of 50% cotton ($MaterialShare_1 = 0.5$) and 50% polyester ($MaterialShare_2 = 0.5$). As the fibre fragment inventory for blended polyester-cotton fabrics is not available at the time of publication, the proxy of 100% cotton fabric for 50% of the product and 100% polyester fabric for the other 50% of the product shall be used. A t-shirt is worn twice (UsePerCareCycle = 2) before being washed according to Table 40.

For cotton, the closest proxy in TMC’s 2024 Microfibre Data Portal Annual Insights for the composition is “Staple fibre” and for the fabric structure “Weft knit”. For polyester, the closest proxy in TMC’s 2024 Microfibre Data Portal Annual Insights for the composition is “Staple fibre” and for the fabric structure “Weft knit”. The fibre fragment inventory is obtained using Equation 14 (AvgFFLoss provided are from the TMC 2024 Microfibre Data Portal Annual Insights).

$$FFLoss_{Cotton} = \frac{0.17\ kg}{2\ uses/wash} * \left(50\%\ share\ of\ cotton * AvgFFLoss_{CottonWeftKnit}\right)$$

$$= \frac{0.17\ kg}{2\ uses/wash}$$

$$* (0.5 * 0.749 \text{ g fibre fragment emitted/kg of product/wash})$$

$$= 0.032 \text{ g fibre fragment emitted/use}$$

$$FFLoss_{Polyester}$$

$$= \frac{0.17\ kg}{2\ uses/wash}$$

$$* \left(50\%\ share\ of\ polyester * AvgFFLoss_{PolyesterWeftKnit}\right)$$

$$= \frac{0.17\ kg}{2\ uses/wash}$$

$$* (0.5 * 0.749 \text{ g fibre fragment emitted/kg of product/wash})$$

$$= 0.032 \text{ g fibre fragment emitted/use}$$

Equation 14

The fibre fragment inventory of each material is then multiplied by the characterisation factor of each material (directly available in this case) as per Equation 15 for the midpoint impact and Equation 16 for the endpoint impact..

$$MidpointImpact_{Cotton} = FFLoss_{Cotton} * MidpointCF_{Cotton,10\mu m}$$

$$= \frac{0.032 \text{ g fibre fragment emitted/use}}{1000 \text{ g/kg}} * 1.04 * 10^5 \text{ PAF} * \text{m3}$$

$$* \text{day/ kg fibre fragment emitted} = 3.32 \text{ PAF} * m^3 * \frac{\text{day}}{\text{use}}$$

$$MidpointImpact_{Polyester} = FFLoss_{Polyester} * MidpointCF_{PET,10\mu m}$$

$$= \frac{0.032 \text{ g fibre fragment} \frac{\text{emitted}}{\text{use}}}{1000 \frac{\text{g}}{\text{kg}}} * 1.40 * 10^7 \text{ PAF} * \text{m3}$$

$$* \text{day/ kg fibre fragment emitted} = 444.26 \text{ PAF} * m^3 * \frac{\text{day}}{\text{use}}$$

Equation 15

$$EndpointImpact_{Cotton} = FFLoss_{Cotton} * EndpointCF_{Cotton,10\mu m}$$

$$= \frac{0.032 \text{ g fibre fragment emitted/use}}{1000 \text{ g/kg}} * 2.86 \text{ PDF} * \text{m2}$$

$$* \text{year/ kg fibre fragment emitted} = 9.12 * 10^{-5} \text{ PDF} * m^2 * \frac{\text{year}}{use}$$

$$EndpointImpact_{Polyester} = FFLoss_{Polyester} * EndpointCF_{PET,10\mu m}$$

$$= \frac{0.032 \text{ g fibre fragment} \frac{\text{emitted}}{\text{use}}}{1000 \frac{\text{g}}{\text{kg}}} * 383.80 \text{ PDF} * \text{m2}$$

$$* \text{year/ kg fibre fragment emitted} = 1.22 * 10^{-2} \text{ PDF} * m^2 * \frac{\text{year}}{use}$$

Equation 16

The midpoint and endpoint impacts of each material are then summed to obtain the total fibre fragment impact as per Equation 17 for the midpoint impact and Equation 18 for the endpoint impact.

$$MidpointImpact$$

$$= FFLoss_{Cotton} * MidpointCF_{Cotton,10\mu m} + FFLoss_{Polyester}$$

$$* MidpointCF_{PET,10\mu m}$$

$$= \frac{0.032 \text{ g fibre fragment emitted/use}}{1000 \text{ g/kg}} * 1.04 * 10^5 \text{ PAF} * \text{m3}$$

$$* \text{day/kg fibre fragment emitted} + \frac{0.032 \text{ g fibre fragment emitted/use}}{1000 \text{ g/kg}}$$

$$* 1.40 * 10^7 \text{PAF} * \text{m3} * \text{day/ kg fibre fragment emitted} = 3.32 + 444.26$$

$$= 447.57 \text{ PAF} * \text{m3} * \text{day/use}$$

Equation 17

$$EndpointImpact$$

$$= FFLoss_{Cotton} * EndpointCF_{Cotton,10\mu m} + FFLoss_{Polyester}$$

$$* EndpointCF_{PET,10\mu m}$$

$$= \frac{0.032 \text{ g fibre fragment} \frac{\text{emitted}}{\text{use}}}{1000 \frac{\text{g}}{\text{kg}}} * 2.86 \text{ PDF} * \text{m2}$$

$$* \frac{\text{year}}{\text{kg}} \text{fibre fragment emitted} + \frac{0.032 \text{ g fibre fragment} \frac{\text{emitted}}{\text{use}}}{1000 \frac{\text{g}}{\text{kg}}}$$

$$* 383.80 \text{ PDF} * \text{m2} * \text{year/ kg fibre fragment emitted}$$

$$= 9.12 * 10^{-5} + 1.22 * 10^{-2} = 1.23 * 10^{-2} \text{ PDF} * \text{m2} * \text{year/ use}$$

Equation 18

## 3.8 Limitations

The following limitations shall be included in the PEF study report when conducting PEF studies in accordance with this PEFCR:

- Because the PEF method is product- and not user- centric, this PEFCR does not allow for differentiation between the impact of a new or second-hand item.
- The allocation for raw material and product transport is mass-based. This may underestimate the environmental impacts from the transport of products with a low density (high volume per mass). To evaluate this, more information on product volume and weight is needed. We recommend investigating this topic by gathering data in a next version of this PEFCR.
- The duration of service of items is included in this PEFCR, but its granularity regarding garment characteristics is low, as there is a lack of robust data assessing the duration of services in number of uses, correlating it with such garment attributes like garment type, fibre composition, fabric structure or garment construction. Intrinsic durability calculations have limitations, as the link between product performance in laboratory tests and the associated performance thresholds, and how a product breaks down due to wearing and domestic care is still being studied. Additionally, the assessment of colour damage could be further refined with more granularity regarding different colour effects (dark, light, solid, shot, etc.). Further studies should also aim to precisely define the levels of degradation which the majority of consumers would consider end of life and use these endpoints to set relevant thresholds for laboratory testing. Furthermore, the methodology to measure the duration of service is highly debated and may be refined in the future. Non-physical durability attributes such as design (use of adjustable design features such as adjustable waist, enabling detaching and replacing parts such as pockets), or making the garment fit for different purposes, which may have an impact on how long a single user will use a product, are not included in this PEFCR. See more details in Section 3.3.2.1 and ANNEX VI – Exploring the extrinsic durability of apparel and footwear products.

- Toxicity aspects are measured with the LCIA method USEtox, which includes human toxicity (cancer and non-cancer effects) and freshwater ecotoxicity, but no marine water or terrestrial ecotoxicity for the moment. This method therefore does not cover the full impacts of chemicals on humans and ecosystems, which are covered by chemical legislation and other methodologies in Europe.
- This PEFCR contains several exemptions for genuine leather and fur products:
    - The durability tables listed in ANNEX V – Detailed requirements regarding intrinsic durability do not apply
    - Specific garment use instructions for these products shall be followed, the general washing and cleaning tables for modelling the use phase don't apply
    - The model for fibre fragment releases related to the cleaning processes don't apply to these products
- The durability tables listed in ANNEX V – Detailed requirements regarding intrinsic durability do not apply to menstrual underwear and are optional for small series. Hence, for these products, the durability multiplier defined in Section 3.3.3 doesn't necessarily apply. As a result:
    - the footprint of menstrual underwear shall not be compared to the footprint of other underwear
    - the footprint of small series for which no durability testing has been conducted shall not be compared to the footprint of other apparel and footwear products
- The repair costs are based on repairs in France and lack representativeness on an EU scale. It is recommended to update the data as soon as more recent and representative information is available on country-specific repair costs to ensure the data remains aligned with current market price evolutions.
- Recycling pathways, especially textile-to-textile or footwear-to-footwear, are expected to develop rapidly in the next few years. It will be therefore necessary to enrich further the current draft related to the verifiable evidence to be given for using a factor of $R_2>0$, especially in the case of a garment with recyclability disruptors.
- The initial fibre fragment impact assessment included in these PEFCR is limited and embeds a high uncertainty (both from the inventory data and the modelling

used). The TMC test method is a quantification of fibre release from fabrics during **simulated domestic laundering,** reflecting the **initial** washing cycle. The total fibre shedding through domestic laundry or other apparel care is, therefore, only an approximation. Furthermore, no inventory data is available on fibre shedding during the use phase nor on fibre emissions in the manufacturing process. It is recommended to update the approach as soon as more information is available to:

  - Cover the entire lifecycle of apparel and footwear products, including production of raw materials, and shedding during use (wear) and end-of-life.
  - Include the impact of fibre fragments on the entire marine compartment, as well as on any other relevant environmental compartment such as freshwater, air and land.

- Using a standard size of M can lead to inconsistencies between brands, as companies have different size tables according to their targeted customers.

This PEFCR has a time validity until 31st December 2027. Should the EF database version 4.0 be made available before that date, the expiry date of the PEFCR will then match the publication date of the EF database. Updates may be conducted earlier should any key limitation need to be resolved, key technologies change (e.g. recycling), or should better data be made available to inform the default product duration of service per product sub-category (see Table 6).

### 3.8.1 Comparisons and comparative assertions

According to Section A.3.1 in Annex A of the PEF method, a product of a sub-category (e.g., sub-category 1, T-shirts) can be compared to the RP as well as to any other product of this sub-category.

Comparison and comparative assertions of products of the same sub-category should acknowledge the vast variety of products and their functions within that sub-category. E.g., a blazer as well as a raincoat belong to the jackets and coats sub-category. The corresponding function «Garment to put on top of a shirt or sweater or to protect from the elements" provides a very general description. However, more specific aspects such as the degree of protection, which is provided, but also more subjective aspects

such as to the conditions when a garment will be worn, are also determining the intended function at the consumer level. A more detailed definition of the functional unit and the sub-categories in the future can facilitate more robust and meaningful comparisons and comparative assertions.

For every internal use of this PEFCR and for eco-design purposes, it is recommended that while conducting comparisons of PEF study results, the limitations highlighted in section 3.8 of this PEFCR should be taken into account, and the materiality of the limitations for external communication vs. internal communication are evaluated accordingly.

Due to the exemptions related to some products (see also section 3.8), the following restrictions regarding comparisons and comparative assertions are set:

- Genuine leather and/or fur apparel products shall not be compared to the footprint of other apparel products.
- The footprint of menstrual underwear shall not be compared to the footprint of other underwear.
- The footprint of small series for which no durability testing has been conducted shall not be compared to the footprint of other apparel and footwear products.

This PEFCR does not allow the use of single score results for making business to consumer comparisons and comparative assertions between the product under study and the benchmarks provided in Section 7.1, as described in Section 7.4. Only characterized or normalized results for at least the first four most relevant indicators shall be used as a basis for these comparisons and comparative assertions.

### 3.8.2 Data gaps and proxies

#### 3.8.2.1 Data gaps frequently encountered for company-specific data

The list of mandatory data points provided in Section 5.1 has been adapted to ensure there is no recurring company-specific data gap. Some data points, namely the share of unsold consumer products and the company level air cargo distances and share of product mass transported might be more difficult to find. However, due to the

significance of these two data points, it was decided to keep them as mandatory data points without which compliance with this PEFCR cannot be obtained.
In the future, more primary data related to the lifespan of garments and footwear may be made available to increase the robustness of key parameters such as the number of wears before a care cycle. In the meantime, the default duration of service as described in Section 3.3.2.2 shall be used.

#### 3.8.2.2 Processes excluded from the PEFCR due to missing datasets

No processes are excluded from the PEFCR due to missing datasets.

#### 3.8.2.3 Data gaps for secondary datasets and guidance to select proxies

ANNEX VII – Inventory modelling and default datasets (“Data gaps proxies” tab) contains a list of datasets that could not be found in the EF database at the time the PEFCR was developed because no exact match was found during the supporting studies and PEF-RP study (e.g., exact fibre but not produced in the exact region). Should there be an exact match in the version of the EF database available during further PEF studies, that exact match shall be used instead of the recommendations from Annex VII (“Data gaps proxies” tab).
Significant investments are being made in both the innovation and scalability of apparel and footwear recycling. Several pathways and technologies are in development, but only the recycling pathways currently implemented at scale are considered in this version of the PEFCR.

In case of no exact match between the dataset and the system modelled (type of material, technology of the process, geographic representativeness, etc.), the user of the PEFCR shall follow the guidance below to choose the best proxy.

In case the best proxy isn’t fully covering the process modelled (e.g. only the first step of a multi-step process), the LCA practitioner shall find as many additional proxies as needed to model the missing steps.

**Life Cycle Stage 1 – Raw materials acquisition and pre-processing:**

- For natural materials, a dataset based on the closest animal or vegetal species shall be chosen. For synthetic materials, the closest material based on the synthesis route of the polymer shall be selected.
- Should different datasets be available for that material proxy in the EF database (e.g. leather, cattle), the closest one shall be selected (e.g., chrome, olive-leaf or vegetable tanning).
- When multiple locations are available for the same raw material (e.g., coconut fiber from Philippines, India or Sri Lanka):
    - For natural materials, the location with the closest climate conditions shall be chosen (e.g. dry conditions requiring more irrigation);
    - For synthetic materials, the location with the most similar electricity mix shall be chosen (e.g. high share of renewables in the local electricity mix). This assessment shall be based on the information provided by the EF database documentation first, and on the International Energy Agency[21] otherwise if needed.
- Should the user of the PEFCR have no information on the origin of the material, a global location (GLO) shall be used.

**Life Cycle Stage 2 - Manufacturing**

- A dataset based on the same material form shall be selected (e.g., fiber or yarn or fabric)
- Should there be more than one process for that manufacturing stage available in the EF database, the most similar process to the one under study shall be selected (e.g., dyeing, knitting, bonding, foaming etc.).
    - Recycled synthetic fibres that are spun from fibers shall use “spinning (production mix)” as proxy
- If multiple technologies are available for the same manufacturing stage, the most similar one for the most appropriate material shall be selected (e.g., batch dyeing vs continuous dyeing). To help select a proxy for spinning based on yarn

[21] https://www.iea.org/countries

size and textile formation based on yarn count, please look at the following resources:

  - For spinning based on yarn size: https://howtohigg.org/higg-msi/textiles/yarn-formation-method/
  - For textile formation based on yarn count: https://howtohigg.org/higg-msi/textiles/textile-formation/

- When multiple locations are available for the same technology, the location with the most similar electricity mix shall be chosen (e.g. high share of renewables in the local electricity mix). This assessment shall be based on the information provided by the EF database documentation first, and on the International Energy Agency[22] otherwise if needed.
- Should the user of the PEFCR have no information on the origin of the material, a global location (GLO) shall be used.
- For user of the PEFCR lacking information on the manufacturing processes included in their value chain (aside from assembly), default modelling guidance is provided in Section 6.2.

**Other Life Cycle Stages**

- If no exact match can be found, the user of the PEFCR shall use the default datasets provided in ANNEX VII – Inventory modelling and default datasets ("Default datasets & DQR" tab).

#### 3.8.2.4 List of processes requiring ILCD-EL compliant proxies

In case of waste treatment outside of Europe, the default dataset for the landfilling of textiles as provided in ANNEX VII – Inventory modelling and default datasets ("Data gap proxies" tab) may be used.

[22] https://www.iea.org/countries

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

| | |
|---|---|
| Note | All the tables included in this section are based on the PEF-RP study v3.1. The PEF-RP study is using representative products based on EU averages (average BOMs mixing natural and synthetic raw materials) to identify the hotspots per product sub-category. Studies conducted on real products might yield slightly different results (e.g. the use stage of a product using a high impacting material in high quantities might not be a hotspot). |

## 4.1 Most relevant EF impact categories

*The most relevant impact categories per product sub- category are listed* in Table 12, as calculated in the PEF-RP study v3.1:

Table 12 - Most relevant impact categories per RP

| Impact category | RP1 | RP2 | RP3 | RP4 | RP5 | RP6 | RP7 | RP8 | RP9 | RP10 | RP11 | RP12 | RP13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Climate change | **19%** | **21%** | **16%** | **18%** | **20%** | **20%** | **21%** | **21%** | **24%** | **16%** | **19%** | **18%** | **18%** |
| Ozone depletion | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Human toxicity, cancer | 1% | 1% | 0% | 1% | 1% | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% |
| Human toxicity, non-cancer | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 2% | 1% | 1% | 5% | 3% | 4% |
| Particulate matter | **17%** | **19%** | **15%** | **18%** | **19%** | **18%** | **19%** | **17%** | **20%** | **17%** | **17%** | **17%** | **17%** |
| Ionising radiation | 1% | 1% | 0% | 0% | 1% | 1% | 1% | 1% | 1% | 0% | 0% | 0% | 0% |
| Photochemical ozone formation | 3% | 3% | 2% | 2% | 3% | 3% | 3% | 3% | 4% | 2% | 4% | 3% | 4% |
| Acidification | **6%** | **6%** | **12%** | **10%** | **6%** | **7%** | **8%** | **6%** | **7%** | **13%** | **10%** | **10%** | **10%** |
| Eutrophication, terrestrial | 3% | 3% | **8%** | **7%** | 3% | 4% | 4% | 3% | 3% | **9%** | **7%** | **7%** | **7%** |
| Eutrophication, freshwater | 3% | 2% | 2% | 2% | 2% | 2% | 2% | 3% | 1% | 2% | 1% | 1% | 1% |
| Eutrophication, marine | **4%** | 3% | **9%** | **7%** | 3% | **4%** | 4% | **3%** | 3% | **8%** | **5%** | **6%** | **5%** |
| Ecotoxicity, freshwater | 3% | 3% | **12%** | **9%** | 3% | 4% | **5%** | 3% | 3% | **10%** | **8%** | **9%** | **8%** |
| Land use | 2% | 2% | **9%** | 5% | 2% | 2% | 2% | 2% | 0% | 4% | 3% | 3% | 3% |
| Water use | **19%** | **16%** | **8%** | **8%** | **14%** | **15%** | **10%** | **16%** | **4%** | **8%** | 3% | 5% | 3% |
| Resource use, minerals and metals | **7%** | **7%** | 2% | 6% | **8%** | **6%** | **6%** | **6%** | **10%** | 3% | **6%** | **6%** | **7%** |
| Resource use, fossils | **12%** | **13%** | 5% | **8%** | **13%** | **11%** | **13%** | **13%** | **18%** | 6% | **11%** | **9%** | **10%** |
| Total most relevant contribution (%) | **83%** | **81%** | **88%** | **83%** | **80%** | **81%** | **82%** | **82%** | **83%** | **81%** | **82%** | **83%** | **82%** |

Note: RP1. T-shirts, RP2. Shirts and blouses, RP3. Sweaters and midlayers, RP4. Jackets and coats, RP5. Pants and shorts, RP6. Dresses, skirts and jumpsuits, RP7. Leggings, stockings, tights and socks, RP8. Underwear, RP9. Swimwear, RP10. Apparel accessories, RP11. Open-toed shoes, RP12. Closed-toed shoes, RP13. Boots.

## 4.2 Most relevant life cycle stages

The most relevant life cycle stages for per product sub-category are listed in Table 13, as calculated in the PEF-RP study v3.1:

Table 13 - Most relevant life cycle stage per impact categories per RP

| Impact category | RP1 | RP2 | RP3 | RP4 | RP5 | RP6 | RP7 | RP8 | RP9 | RP10 | RP11 | RP12 | RP13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Climate change | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2, 4 | 1, 2, 4 | 1, 2 | 1, 2 | 1, 2 | 1, 2 |
| Ozone depletion | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Human toxicity, cancer | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Human toxicity, non-cancer | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Particulate matter | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1 | 1, 2 |
| Ionising radiation | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Photochemical ozone formation | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acidification | 1, 2 | 1, 2 | 1 | 1 | 1, 2 | 1, 2 | 1, 2 | 1, 2, 4 | 1, 2, 4 | 1 | 1 | 1 | 1 |
| Eutrophication, terrestrial | -- | -- | 1 | 1 | -- | -- | -- | -- | -- | 1 | 1 | 1 | 1 |
| Eutrophication, freshwater | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Eutrophication, marine | 1, 2 | -- | 1 | 1 | -- | 1, 2 | -- | 1, 2 | -- | 1 | 1 | 1 | 1 |
| Ecotoxicity, freshwater | -- | -- | 1 | 1 | -- | -- | 1, 2 | -- | -- | 1 | 1 | 1 | 1 |
| Land use | -- | -- | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Water use | 1, 2 | 1 | 1 | 1 | 1 | 1 | 1, 2 | 1 | 2, 4 | 1 | -- | -- | -- |
| Resource use, minerals and metals | 1, 2 | 1, 2 | -- | -- | 1, 2 | 1, 2 | 1, 2 | 1, 2, 4 | 1, 2 | -- | 1 | 1 | 1 |
| Resource use, fossils | 1, 2 | 1, 2 | -- | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2, 4 | 1, 2 | -- | 1, 2 | 1, 2 | 1, 2 |

Note: RP1. T-shirts, RP2. Shirts and blouses, RP3. Sweaters and midlayers, RP4. Jackets and coats, RP5. Pants and shorts, RP6. Dresses, skirts and jumpsuits, RP7. Leggings, stockings, tights and socks, RP8. Underwear, RP9. Swimwear, RP10. Apparel accessories, RP11. Open-toed shoes, RP12. Closed-toed shoes, RP13. Boots.

1. Raw materials extraction and pre-processing, 2. Manufacturing, 3. Distribution, 4. Use, 5. End of life.

## 4.3 Most relevant processes

The most impacting processes for the product category in scope of this PEFCR are indicated by a cross in Table 14, as calculated in the PEF-RP study v3.1:

Table 14 - Most impacting processes per product sub-category

| Process per life cycle stage (LCS) | RP1 | RP2 | RP3 | RP4 | RP5 | RP6 | RP7 | RP8 | RP9 | RP10 | RP11 | RP12 | RP13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LCS1: Raw material acquisition and pre-processing | | | | | | | | | | | | | |
| Cashmere fiber {GLO} \| raw \| production mix \| LCI result | -- | -- | X | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Cotton fibre {GLO} \| technology mix \| production mix, at farm \| "as is" delinted product \| LCI result | X | X | X | X | X | X | X | X | -- | X | -- | -- | -- |
| Leather, cattle, chrome tanned (wet-blue) {GLO} \| technology mix \| production mix, at tannery \| m2 \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | X | X |
| Leather, veal/calf, chrome tanned (wet-blue) {GLO} \| technology mix \| production mix, at tannery \| m2 \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | X | X |
| Leather, ovine (sheep), chrome tanned (wet- blue) {GLO} \| technology mix \| production mix, at tannery \| m2 \| LCI result | -- | -- | -- | -- | X | -- | -- | -- | -- | X | X | -- | X |
| Leather, caprine (goat), chrome tanned (wet- blue) {GLO} \| technology mix \| production mix, at tannery \| m2 \| LCI result | -- | -- | -- | -- | X | -- | -- | -- | -- | X | X | X | X |
| Leather, swine, chrome tanned (wet-blue) {GLO} \| technology mix \| production mix, at tannery \| m2 \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- |
| Nylon 6, fossil fuel-based {GLO} \| hydrolytic polymerisation of caprolactam \| production mix, at plant \| petrochemical based \| LCI result | -- | -- | -- | X | X | -- | X | X | X | -- | -- | -- | -- |

| Process per life cycle stage (LCS) | RP1 | RP2 | RP3 | RP4 | RP5 | RP6 | RP7 | RP8 | RP9 | RP10 | RP11 | RP12 | RP13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PET granulates, bottle grade {EU+EFTA+UK} \| via purified terephthalic acid (PTA) and ethylene glycol \| production mix, at plant \| 192.17 g/mol per repeating unit \| LCI result | X | X | -- | X | X | X | X | X | X | -- | X | X | X |
| Silk {GLO} \| drying, immersion, brushing, reeling \| production mix, at plant \| 1 kg \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- |
| Wool {GLO} \| sheep \| production mix, at farm \| 1 kg wool \| LCI result | -- | -- | X | X | -- | X | X | -- | -- | X | -- | X | -- |
| Dressed mink fur, farmed, global origin except china {GLO} \| technology mix \| production mix, at plant \| 1kg \| LCI result | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acrylic fiber {GLO} \| polymerisation of acrylonitrile with the ethyl acetate, spinning, post-spinning treatment \| production mix, at plant \| petrochemical based \| LCI result | -- | -- | -- | X | -- | -- | X | -- | -- | X | -- | -- | -- |
| Styrene-butadiene rubber (SBR) fiber {EU+EFTA+UK} \| Emulsion polymerization of styrene and butadiene \| production mix, at plant \| 23.5 % styrene \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | X | X |
| Ethylene vinyl acetate copolymer {GLO} \| Technology mix \| Production mix, at plant \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- |
| Thermoplastic polyurethane (TPU) {GLO} \| reaction of diisocyanates (hard segment) with diols (soft segment) \| production mix, at plant \| petrochemical based \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X |
| Viscose fibre {GLO} \| virgin production from hardwood sulphite pulp \| production mix, at plant \| 1kg of product \| LCI result | -- | -- | -- | X | -- | -- | X | -- | -- | -- | -- | -- | -- |
| Elastane fibre / spandex {GLO} \| dry spinning, extrusion, texturising \| production mix, at plant \| 1kg of product \| LCI result | -- | -- | -- | -- | -- | -- | X | -- | X | -- | X | X | X |
| Latex production {GLO} \| technology mix \| production mix, at plant \| 100% active substance \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- |
| Zipper tape and puller, metal {GLO} \| production, at plant \| 1kg of product, brass zipper \| LCI result | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | X |
| Stainless steel hot rolled {RoW} \| hot rolling \| production mix, at plant \| stainless steel \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X |
| Shoe eyelet, metal {GLO} \| production, at plant \| 1kg of product, brass based \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | X | X |

| Process per life cycle stage (LCS) | RP1 | RP2 | RP3 | RP4 | RP5 | RP6 | RP7 | RP8 | RP9 | RP10 | RP11 | RP12 | RP13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plastic bag, LDPE {EU+EFTA+UK} \| raw material production, plastic extrusion \| production mix, at plant \| thickness: 0.03 mm, grammage: 0.0275 kg/m2 \| LCI result | X | -- | -- | -- | -- | -- | X | X | -- | -- | -- | -- | -- |
| Cardboard, production mix, at plant {GLO} \| Kraft Pulping Process \| production mix, at plant \| 180- 300 kg/m3 \| LCI result | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | X | -- | -- |
| Cargo plane {GLO} \| technology mix, kerosene driven, cargo \| consumption mix, to consumer \| 65 t payload \| LCI result | X | X | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- |
| Transoceanic ship, containers {GLO} \| heavy fuel oil driven, cargo \| consumption mix, to consumer \| 27.500 dwt payload capacity, ocean going \| LCI result | -- | X | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- |
| LCS2: Manufacturing | | | | | | | | | | | | | |
| Spinning, for knit, ring-spun {GLO} \| spinning process \| production mix \| service of spinning 1kg of yarn (raw material excluded) \| LCI result | X | X | X | -- | X | X | X | X | -- | -- | -- | -- | -- |
| Spinning, for woven, ring-spun {GLO} \| spinning process \| production mix \| service of spinning 1kg of yarn (raw material excluded) \| LCI result | -- | X | -- | X | X | X | -- | X | -- | X | -- | X | -- |
| Spinning, continuous filament (dry) {GLO} \| spinning process \| production mix \| service of spinning 1kg of yarn (raw material excluded) \| LCI result | -- | -- | -- | X | X | -- | X | -- | X | -- | -- | X | -- |
| Knitting, circular {GLO} \| knitting process \| production, at plant \| service of knitting fabric \| LCI result | X | X | X | X | X | X | X | X | X | X | -- | -- | -- |
| Knitting, flat {GLO} \| knitting process \| production, at plant \| service of knitting fabric \| LCI result | -- | -- | X | -- | -- | -- | -- | -- | -- | X | -- | -- | -- |
| Weaving (different fabric counts) {GLO} \| service, Fabric, Weaved, Mix of different counts \| production mix, at plant \| service, Fabric, Weaved, Mix of different counts \| LCI result | -- | X | -- | X | X | X | -- | X | X | X | X | X | X |
| Pre-dye preparation (scouring, etc), knit textile, natural fibers {GLO} \| Pre-treatment \| production mix, at plant \| textile service \| LCI result | X | X | -- | X | X | X | X | X | X | -- | -- | -- | -- |
| Dyeing, batch (incl. piece, jet, jig, kier, yarn), acid dyes {GLO} \| Dyeing \| production mix, at plant \| textile service for 1 kg of fabric \| LCI result | -- | -- | -- | X | X | -- | X | X | X | X | -- | X | -- |

| Process per life cycle stage (LCS) | RP1 | RP2 | RP3 | RP4 | RP5 | RP6 | RP7 | RP8 | RP9 | RP10 | RP11 | RP12 | RP13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dyeing, batch (incl. piece, jet, jig, kier [fiber], paddle, pad-batch, yarn), direct, sulfur, vat or reactive dyes {GLO} \| Dyeing \| production mix, at plant \| textile service for 1 kg of fabric \| LCI result | X | X | -- | -- | X | X | X | X | -- | -- | -- | -- | -- |
| Dyeing, batch (incl. piece, jet, jig, kier, yarn), disperse or cationic dyes {GLO} \| Dyeing \| production mix, at plant \| textile service for 1 kg of fabric \| LCI result | X | X | -- | X | X | X | X | -- | X | -- | -- | X | -- |
| Printing, screen {GLO} \| printing service \| production, at plant \| service of printing, Screen on 1m2 of fabric \| LCI result | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- | -- | -- |
| Finishing, stain resistant/stain release {GLO} \| pad dry-cure method \| production mix, at plant \| service \| LCI result | X | X | -- | X | X | X | X | X | X | X | -- | X | X |
| Injection molding, for foam {GLO} \| injection process \| production mix, at plant \| item(s) = pair \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | X | X |
| Lamination, water based glue {GLO} \| lamination process \| average service, at plant \| 1 kg of water based glue laminated fabric \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | X | X |
| Coating, water based emulsion {GLO} \| Finishing \| technology mix \| textile service for 1 kg of fabric \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | X | X |
| Cementing/gluing {GLO} \| cementing process \| production mix, at plant \| service of glueing 1 pair of shoes \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | X | -- |
| Vulcanizing {GLO} \| vulcanizing, press vulcanisation- injection molding \| production mix, at plant \| service for 1 pair \| LCI result | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | -- |
| Transoceanic ship, containers {GLO} \| heavy fuel oil driven, cargo \| consumption mix, to consumer \| 27.500 dwt payload capacity, ocean going \| LCI result | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- |
| LCS3: Distribution | | | | | | | | | | | | | |
| Cargo plane {GLO} \| technology mix, kerosene driven, cargo \| consumption mix, to consumer \| 65 t payload \| LCI result | X | X | -- | X | X | X | X | X | X | X | X | X | X |
| Transoceanic ship, containers {GLO} \| heavy fuel oil driven, cargo \| consumption mix, to consumer \| 27.500 dwt payload capacity, ocean going \| LCI result | X | X | -- | -- | X | -- | -- | X | X | -- | X | -- | -- |
| Electricity grid mix 1kV-60kV {EU+EFTA+UK} \| technology mix \| consumption mix, to consumer \| 1kV - 60kV \| LCI result | -- | X | -- | -- | -- | X | -- | -- | -- | -- | -- | X | X |

| Process per life cycle stage (LCS) | RP1 | RP2 | RP3 | RP4 | RP5 | RP6 | RP7 | RP8 | RP9 | RP10 | RP11 | RP12 | RP13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thermal energy from natural gas {EU+EFTA+UK} \| technology mix regarding firing and flue gas cleaning \| production mix, at heat plant \| MJ, 100% efficiency \| LCI result | -- | X | -- | -- | -- | X | -- | -- | -- | -- | -- | X | X |
| LCS4: Use stage | | | | | | | | | | | | | |
| Handwashing {EU+EFTA+UK} \| handwashing process \| production mix, at plant \| service \| LCI result | -- | -- | -- | -- | -- | -- | -- | X | X | -- | -- | -- | -- |
| Washing, 40 degrees C, average {EU+EFTA+UK} \| washing, warm water \| production mix, at plant \| service \| LCI result | X | X | -- | -- | X | X | X | -- | -- | -- | -- | -- | -- |
| Washing, 60 degrees C, average {EU+EFTA+UK} \| washing, warm water \| production mix, at plant \| service \| LCI result | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- | -- | -- |
| Washing, dry cleaning {EU+EFTA+UK} \| washing process \| production mix, at plant \| service \| LCI result | -- | -- | -- | -- | X | X | -- | -- | -- | -- | -- | -- | -- |
| Tumble drying {EU+EFTA+UK} \| drying, condenser tumble dryer \| production mix, at plant \| service \| LCI result | X | -- | -- | -- | X | X | X | X | X | -- | -- | -- | -- |

Note: RP1. T-shirts, RP2. Shirts and blouses, RP3. Sweaters and midlayers, RP4. Jackets and coats, RP5. Pants and shorts, RP6. Dresses, skirts and jumpsuits, RP7. Leggings, stockings, tights and socks, RP8. Underwear, RP9. Swimwear, RP10. Apparel accessories, RP11. Open-toed shoes, RP12. Closed-toed shoes, RP13. Boots.

## 4.4 Most relevant elementary flows

| | |
|---|---|
| Note | Due to the inaccessibility of disaggregated datasets in the EF 3.1 database, the most relevant direct elementary flows could not be identified at this stage. |

# 5 Life cycle inventory

This chapter defines which data need to be collected to conduct a PEF study according to this PEFCR. All newly created datasets shall be EF compliant. Sections 5.1.2 to 5.1.6 indicate the specific data collection requirements and accompanying documents needed for the “mandatory” and “mandatory, if available” data.

There are 3 types of information in related to the specific data:

- **Document information:** Refer to the document containing the data to be collected.
- **Calculation:** Refer to the calculation required to obtain the data.
- **Collection period:** Refer to the time period for the collection of primary data.

Where data is required, it must always be representative of the production and up to date.

For all other processes the Data Needs Matrix is applicable, as explained in Section 5.4.

## 5.1 List of mandatory company-specific data

The following company-specific data shall be collected by companies using this PEFCR, with a data quality rating (DQR) ≤1.5, as calculated using Equation 20 and Table 16. They are summarised in Table 15 but detailed in the next sub-sections.

Some data is flagged as “mandatory, if available”. ‘If available’ shall be interpreted as obtained by the user of the PEFCR by asking the relevant direct or indirect business partner.

Table 15 - Summary of mandatory and “mandatory if available” company-specific data

| Life cycle stage | Mandatory / mandatory if available company-specific data |
|---|---|
| LCS1<br>Raw materials acquisition and pre-processing | • At least 95% of the product’s Bill Of Materials (BOM) by weight, covering 100% of the main fabrics, lining, padding, and electronic parts and metals<br>• If the BOM isn't available, product weight and reference size<br>• Raw materials mass transported<br>• If available, raw materials transport distances, modes, share of raw material mass transported for each transport leg, and utilisation rates for trucks |
| LCS2<br>Manufacturing | • If the BOM isn’t available, assembly loss rate for the product studied<br>• If available, manufacturing technologies<br>• If available, other processing loss rates<br>• If available, energy mix of the manufacturing steps for the product studied – exempted for SMEs<br>• If available, intermediate product transport distances, modes, share of semi-finished product mass transported for each origin and utilisation rates for trucks |
| LCS3<br>Distribution | • Air cargo distances at company level<br>• Air cargo share of product mass transported for each origin at company level |

| Life cycle stage | Mandatory / mandatory if available company-specific data |
|---|---|
| | • Product weight (if not collected in LCS1)<br>• If available, product transport distances, modes, share of product mass transported for each origin and utilisation rates for trucks |
| LCS4<br>Use | • Apparel: Product type, if delicate product or sportswear |
| LCS5<br>End of life | • N/A |
| General | • Share (% product) of unsold consumer products at product sub-category or product category (apparel and footwear) level<br>• Highly recommended but not mandatory – intrinsic durability tests and repairability information (product selling price in the EU, and repair documentation) |

The EF database provides a large number of relevant datasets. Based on the mandatory, primary data such as the amount of polyester fabric, users of the PEFCR will have to select the most relevant dataset from the EF database for the assessment of LCS1 and LCS2, such as e.g. polyester pellets, but as well the datasets related to the transformation to fabric from spinning to knitting and dyeing for example. Primary data for energy and transport can be used to individualize the supply chain if desired. Companies can also decide to create new EF-compliant datasets fully based on primary data if they wish, aside for LCS4 where the use of secondary data is mandatory. More information on how to create EF compliant datasets can be found here:

https://eplca.jrc.ec.europa.eu/permalink/Guide_EF_DATA.pdf

### 5.1.1 General data collection requirements

Overall, sampling is not allowed in the context of this PEFCR.

The following data requirements are not linked to a specific life cycle stage and therefore mentioned here. All other data collection requirements are specified in the corresponding life cycle stage sections.

- *Share (% product) of unsold consumer products at product sub-category or product category (apparel and footwear) level*

  **Collection period:** The average unsold consumer products rate of the last three administration periods for the product sub-category shall be used, or if not available, at product category level (apparel and footwear). More information on unsold consumer products is available in Section 6.1.1.

- *Highly recommended but not mandatory – intrinsic durability tests and repairability information (product selling price in the EU, and repair documentation)*

Information on the primary data collection for intrinsic durability and repairability are defined:
For intrinsic durability: in Section 3.3.3 and ANNEX V – Detailed requirements regarding intrinsic durability.
For repairability: in Section 3.3.4 Repair/refurbish

### 5.1.2 Life cycle stage 1 – Raw materials (except packaging)

#### 5.1.2.1 Bill of Materials

Primary data shall be provided for at least 95% of the Bill Of Materials (BOM) by weight, covering 100% of the main fabrics, lining, padding, and electronic parts (e.g. lights and batteries in shoes or RFID in outdoor jackets) and metals. The remaining % of the BOM shall be calculated to mirror the garment composition, excluding metals and electronic parts.

The BOM shall include more detailed information such as yarn type (size and construction method), textile formation (average yarn size and textile type - knit/woven/nonwoven), and finishing techniques (chemical finishes such as water repellency, stain release, etc. as well as mechanical or heat treatments such as calendaring, brushing, shearing, etc.) to select the most relevant dataset from the most recent version of the EF database in the modelling of the life cycle stage 2 (Section 6.2).

To illustrate the approach for a t-shirt with a net weight of 85g and a total BOM of 100g covered at 98% (e.g., 80g cotton, 15g polyester and 3g steel) including the main fabrics, lining, padding, electronic parts and metals, the 2% missing, 2g, shall be modelled as 1.7g cotton and 0.3g polyester. If detailed data are available, regionalized data per country shall be used. In the case of an origin from multiple sources, a product weighted average of the different sources shall be used to properly represent the variability, if possible, a company weighted average otherwise. If the product has been made for more than a year, the sourcing data for this material for this specific product shall be used. If the product has been made for less than a year, the sourcing data for the purchase order for this material for this specific product shall be used.

Should the BOM not be available, the product weight and reference size shall be collected to retro-calculate it (see Section 3.3.1 for details).

There are four possible scenarios for raw material transport:

i) In case the exact location of the supplier is known as well as the transport mode (e.g. the specific type of truck, ship and train or plane), the share of product mass transported and utilisation ratio, the user of the PEFCR shall use the specific data available.

The mandatory data are thus the mass transported as defined in Section 6.1.2, the precise transport mode (e.g., truck load, EUROx European emissions standards), the distance per transport mode, the share of product mass transported and the utilisation ratio for truck transport. PEF studies shall specify the utilisation ratio to be used for each truck transport modelled and clearly indicate whether the utilisation ratio includes empty return trips (PEF method).

ii) In case the exact location of the supplier is known as well as the transport mode, but the specific type of truck, ship, train or plane and the share of product mass transported are not known, the user of the PEFCR shall use the specific data available and the default values (including utilisation ratio) for the transport modes given in Table 32.

The mandatory data are thus the mass transported as defined in Section 6.1.2, the transport mode, but not specific (e.g., truck load, EUROx European emissions standards), and the distance per transport mode.

iii) In case the only specific information available is whether or not the supplier is located in the same continent as the processing plant or the location of the supplier but not the transport mode, the user of the PEFCR shall use the default values provided in Table 32 related to the specific supply chain location, transport modes and shares of product mass transported.

The mandatory data are thus the mass transported as defined in Section 6.1.2, and the approximate location (same continent or not) of the processing plant.

iv) In case no information on the supply chain location is available, the transport shall be modelled as if the supplier is located outside the continent of the processing plant. This shall be done using the default values in Table 32.

The mandatory data are thus the mass transported as defined in Section 6.1.2.

#### 5.1.2.2 Data collection requirement for LCS1

- *At least 95% of the product's Bill of Materials (BOM) by weight, covering 100% of the main fabrics, lining, padding, and electronic parts and metals.*

**Document information:** BOM of the finished product including material. The BOM shall be representative of the production.

- *If the BOM isn't available, product weight and reference size*

**Document information:** Weight of the finished product indicated in the product specification by reference size.
**Calculation:** If the product specification is not available, it is necessary to weigh at least 3 products and calculate the average weight.

- *Raw materials mass transported*

**Calculation:** In order to identify the total mass of raw material transported, it is necessary to calculate the amount of raw materials needed to create one product. This amount shall take into account all the losses that occur throughout the product's life cycle (pre-processing losses, manufacturing leftovers, manufacturing losses (including assembly losses), unsold consumer products and distribution losses).

- *If available, raw materials transport distances, modes, provenance (share of total transport), and utilisation rates for trucks*

**Collection period:** Annual administrative period as a basis for the data collection

### 5.1.3 Life cycle stage 2 - Manufacturing

#### 5.1.3.1 Manufacturing data

If the BOM is not available, primary data shall be provided for the assembly loss rate for the product studied.

The specific manufacturing technologies shall be used to select the most relevant dataset if available, otherwise default manufacturing datasets can be found in ANNEX VII – Inventory modelling and default datasets ("Default datasets & DQR" tab). Guidance for the selection of the best dataset can be found in Section 3.8.2.3.

If the specific loss rates of the manufacturing steps are available, they shall be used to adapt the most relevant dataset from the most recent version of the EF database.

The specific location of the manufacturing steps shall be determined to select and/or adapt the country energy mix of the datasets as a minimum, and the specific energy type if data are available, unless the user of the PEFCR is an SME without access to specific data, see Section 6.2 for more information.

In case of multiple suppliers, for both the specific energy mix and loss rates, a product weighted average of the data shall be made first or, if not possible, a company weighted

average. No specific time-period to determine the weighted average is required. The user of the PEFCR just shall ensure that the DQR of the information is ≤1.5.

#### 5.1.3.2 Transport data

There are four possible scenarios for semi-finished and intermediate products transport:

i) In case the exact location of the supplier is known as well as the transport mode (e.g. the specific type of truck, ship and train or plane), the share of product mass transported and utilisation ratio, the user of the PEFCR shall use the specific data available.

   The mandatory data are thus the mass transported of the semi-finished & intermediate products at the entry gate of the assembly step as defined in Section 6.2.1, the precise transport mode (e.g., truck load, EUROx European emissions standards), the distance per transport mode, the share of product mass transported and the utilisation ratio for truck transport. PEF studies shall specify the utilisation ratio to be used for each truck transport modelled and clearly indicate whether the utilisation ratio includes empty return trips (PEF method).

ii) In case the exact location of the supplier is known as well as the transport mode, but the specific type of truck, ship, train or plane and the share of product mass transported are not known, the user of the PEFCR shall use the specific data available and the default values (including utilisation ratio) for the transport modes given in Table 32.

   The mandatory data are thus the mass transported of the semi-finished & intermediate products at the entry gate of the assembly step as defined in Section 6.2.1, the transport mode, but not specific (e.g., truck load, EUROx European emissions standards), and the distance per transport mode.

iii) In case the only specific information available is whether or not the supplier is located in the same continent as the processing plant, the user of the PEFCR shall use the default values provided in Table 32 related to the specific supply chain location, transport modes and share of product mass transported.

   The mandatory data are thus the mass transported of the semi-finished & intermediate products at the entry gate of the assembly step as defined in Section 6.2.1, and the approximate location (same continent or not) of the processing plant.

iv) In case no information on the supply chain location is available, the transport shall be modelled as if the supplier is located outside the continent of the processing plant. This shall be done using the default values in Table 32.

The mandatory data are thus the mass transported of the semi-finished & intermediate products at the entry gate of the assembly step as defined in Section 6.2.1.

#### 5.1.3.3 Data collection requirements for LCS2

- *If the BOM isn't available, assembly loss rate for the product studied*

**Assembly loss rate definition:** The assembly loss rate is the total finished material losses in making and assembling a product. This is typically comprised of cutting losses (determined by the marker efficiency) as well as other manufacturing losses due to material defects (e.g. pattern pieces that cannot be used and must be re-cut) and uncorrectable production errors (e.g. sewing errors, embellishment errors, stained pattern pieces)

**Marker efficiency definition:** The marker efficiency, also known as the pattern efficiency, is the area of useful pattern pieces for a product that can be cut from a known area of fabric. Typically, this is calculated in pattern making software.

**Document information:** Product specific marker efficiency for each finished material used in the product. If both production site and a brand's internal marker efficiencies are available, the production site marker efficiency shall be used.

*Note: If the internal marker efficiency is used to generate a procurement amount for a fabric, the total fabric amount should follow the calculation structure for having a Bill of Materials (since the amount of ordered fabric is known).*

**Calculation:** In order to calculate the assembly loss rate, a mass weighted average of the marker efficiency for each finished material of the product must be considered. To this average, an additional 10% loss shall be added to account for production losses.

- *If available, manufacturing technologies*

**Note:** Supporting documents needed to prove the manufacturing technologies (traceability, technology pack (tech pack), audit) will be defined at a later stage if needed.

- *If available, other processing loss rates*

**Calculation:** It is necessary to calculate the amount of input material for that process and the amount of output intermediate product to calculate the loss rate.

**Example:** The input to a dyeing process would be the amount of greige fabric ordered for the appropriate annual administrative period. The output for this dyeing process would be the amount of dyed fabric that meets customer requirements and is shipped. If

10,000,000 kilograms of greige fabric is used and only 9,000,000 kilograms of dyed fabric is shipped, the loss rate would be (10,000,000 - 9,000,000) / 10,000,000 x 100% = 10%
**Collection period:** Annual administrative period as a basis for the data collection of the processing loss rates.

- *If available, energy mix of the manufacturing steps for the product studied – SMEs are exempt*

**Calculation and document information:** Provide the energy mix and applicable certificate depending on the PEF method's electricity modeling requirements (see section 5.8 on electricity modeling).
**Collection period:** Annual administrative period as a basis for the data collection of energy mix.

- *If available, intermediate product transport distances, modes, share of product mass transported and utilisation rates for trucks*

**Collection period:** Annual administrative period as a basis for the data collection
**Note:** Supporting documents needed to prove the transport parameters will be defined at a later stage if needed.

### 5.1.4 Life cycle stage 3 - Distribution

#### 5.1.4.1 Transport scenarios

Primary data at company level shall be used for air cargo distances and share of product mass transported (more details provided in Section 6.3.1). The final product weight shall also be provided.

There are four possible scenarios for each transport leg:

i) In case the transport distances are known as well as the transport mode (e.g. the specific type of truck, ship and train or plane), the share of product mass transported for each origin and utilisation ratio, the user of the PEFCR shall use the specific data available.

The mandatory data are thus the final product weight, the precise transport mode (e.g., truck load, EUROx European emissions standards), the distance per transport mode, the share of product mass transported for each origin and the utilisation ratio for truck transport. PEF studies shall specify the utilisation ratio to be used for each

truck transport modelled and clearly indicate whether the utilisation ratio includes empty return trips (PEF method).

ii) In case the distances are known as well as the transport mode, but the specific type of truck, ship, train or plane and the share of product mass transported for each origin are not known, the user of the PEFCR shall use the specific data available and the default values (including utilisation ratio) for the transport modes given in Table 37.
The mandatory data are thus the final product weight, the transport mode, but not specific (e.g., truck load, EUROx European emissions standards), and the distance per transport mode.

iii) In case the shares of product mass transported for each origin are known as well as the transport mode, but the specific type of truck, ship, train or plane and the distances are not known, the user of the PEFCR shall use the default values provided in Table 37 related to the distances, transport modes and share of product mass transported for each origin.
The mandatory data are thus final product and the shares of product mass transported for each origin.

iv) In case no information on the shares of product mass transported for each origin or the distances are known, the transport shall be modelled using the default values in Table 37.
The mandatory data are thus the final product weight.

The specific utilisation ratio[23] for truck transport shall be used when available, or, if not possible, the default value of 64% from the EF dataset for Truck (>32t, EURO 4) shall be used.

#### 5.1.4.2 Data collection requirements for LCS3

**Note:** Supporting documents needed to prove the transport parameters will be defined at a later stage if needed.

- *Air cargo distances at company level*

**Collection period:** Annual administrative period as a basis for the data collection of air cargo distances.

- *Air cargo share of product mass transported for each origin at company level*

[23] Real load transported divided by the mass of the payload considering empty returns (ratio of the distance travelled to collect the next load after unloading the product to the distance travelled to transport the product).

**Collection period:** Annual administrative period as a basis for the data collection of air cargo distances.

- *Product weight (if not collected in LCS1)*

**Document information:** Weight of the finished product indicated in the product specification by reference size.
**Calculation:** If the product specification is not available. It is necessary to weigh at least 3 products and calculate the average weight.

- *If available, product transport distances, modes, share of product mass transported for each origin and utilisation rates for trucks*

**Collection period:** Annual administrative period as a basis for the data collection

### 5.1.5 Life cycle stage 4 - Use stage

The categorisation of the product as sportwear, or delicate is a mandatory specific data in order to identify the relevant modelling scenarios for the use phase (Table 40).

#### 5.1.5.1 Data collection requirements for LCS4

**Document information:** If delicate product: refer to the care label.
Definitions reminder:
*Delicate garments are defined as items requiring dry cleaning only based on their care label
*Sportswear is defined as garments primarily worn for sports activities, both indoor and outdoor (*Laitala, 2018b)

### 5.1.6 Other primary information

Primary data shall be provided for the share (% product) of unsold consumer products for the average of the last three annual administration periods. Primary data by product sub-category shall be used if available, if not at product category level (Apparel & Footwear). Assessing the intrinsic product quality (see Section 3.3.3) or repairability (see Section 3.3.4) is highly recommended, but not mandatory. Should the LCA practitioner decide to include an intrinsic durability or a repairability multiplier, then primary data shall be used.

See ANNEX VII – Inventory modelling and default datasets (“Data requirements” tab) for the list of all company-specific data to be collected.

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

Apparel and footwear brands don’t typically conduct their own manufacturing, instead relying on relationships with specialised manufacturing facilities. Similarly, distribution does not necessarily include company owned facilities, with third party distribution centres and third-party retailers being common.

While this means that there are no processes that are directly run by the company, the list of mandatory company-specific data from Section 5.1 is information considered to be widely available to apparel and footwear companies.

## 5.3 Data quality requirements

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

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

Equation 19

Where TeR is technological representativeness, GeR is geographical representativeness, TiR is time representativeness, and P is precision. 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 are 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.

### 5.3.1 Company-specific datasets

The scope of primary data collected should follow the scope of the corresponding dataset in the EF database: e.g., if the climatisation of the factory is not included in the spinning dataset, it is not necessary to include it in the primary data.

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 activity data and direct elementary flows: most relevant activity data are the ones linked to sub-processes (i.e. secondary datasets) 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. Most relevant direct elementary flows are defined as those direct elementary flows contributing cumulatively at least with 80% to the total impact of the direct elementary flows.
2. Calculate the DQR criteria TeR, TiR, GeR and P for each most relevant activity data and each most relevant direct elementary flow. The values of each criterion shall be assigned based on Table 16.

    a. Each most relevant direct elementary flow consists of the amount and elementary flow naming (e.g. 40 g carbon dioxide). For each most relevant elementary flow, the user of the PEFCR shall evaluate the 4 DQR criteria named $TeR_{-EF}$, $TiR_{-EF}$, $GeR_{-EF}$, $P_{EF}$. For example, the user of the PEFCR shall evaluate the timing of the flow measured, for which technology the flow was measured and in which geographical area.
    b. For each most relevant activity data, the 4 DQR criteria shall be evaluated (named $T_eR_{-AD}$, $TiR_{-AD}$, $GeR_{-AD}$, $P_{AD}$) by the user of the PEFCR.
    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 GeR cannot be higher than 2 (The DQR score shall be ≤1.5).

3. Calculate the environmental contribution of each most relevant activity data (through linking to the appropriate sub-process) and direct elementary flow to the total sum of the environmental impact of all most-relevant activity data and direct elementary flows, in % (weighted, using all EF impact categories). For example, the newly developed dataset has only two most relevant activity data, contributing in total to 80% of the total environmental impact of the dataset:
    - Activity data 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).

- Activity data 2 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 TeR, TiR, GeR and P criteria of the newly developed dataset as the weighted average of each criteria of the most relevant activity data and direct elementary flows. The weight is the relative contribution (in %) of each most relevant activity data and direct elementary flow calculated in step 3.

The user of the PEFCR shall calculate the total DQR of the newly developed dataset using Equation 20, where, $\underline{\mathrm{TiR}}, \underline{\mathrm{TeR}}, \underline{\mathrm{GeR}}, \underline{\mathrm{P}}$ are the weighted average calculated as specified in point (4).

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

Equation 20

Table 16 - DQR assessment criteria for datasets with company-specific information*

| Rating | $P_{EF}$ and $P_{AD}$ | $TiR_{-EF}$ and $TiR_{-AD}$ | $TeR_{-EF}$ and $TeR_{-AD}$ | $GeR_{-EF}$ and $GeR_{-AD}$ |
|---|---|---|---|---|
| 1 | Measured/calculated and externally verified | The data refers to the most recent annual administration period with respect to the EF report publication date | The elementary flows and the activity data exactly the technology of the newly developed dataset | The activity data and elementary flows reflects the exact geography where the process modelled in the newly created 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 elementary flows and the activity data are a proxy of the technology of the newly developed dataset | The activity data and elementary flows) 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 |

| Rating | $P_{EF}$ and $P_{AD}$ | $TiR_{EF}$ and $TiR_{AD}$ | $TeR_{EF}$ and $TeR_{AD}$ | $GeR_{EF}$ and $GeR_{AD}$ |
|---|---|---|---|---|
| 4-5 | Not applicable | Not applicable | Not applicable | Not applicable |

$P_{EF}$: Precision for elementary flows; $P_{AD}$: Precision for activity data; $TiR_{EF}$: Time Representativeness for elementary flows; $TiR_{AD}$: Time representativeness for activity data; $TeR_{EF}$: Technology representativeness for elementary flows; $TeR_{AD}$: Technology representativeness for activity data; $GeR_{EF}$: Geographical representativeness for elementary flows; $GeR_{AD}$: Geographical representativeness for activity data.

### 5.3.2 DQR of the PEF study

Information on how to calculate the DQR of a PEF study is found in Section 5.6. In case a secondary dataset is identified as a most relevant process in the PEF study, its DQR shall be recalculated according to Section 4.6.5.3 of the PEF method.

## 5.4 Data needs matrix

All processes required to model the product and outside the list of mandatory company-specific data (listed in Section 5.1) shall be evaluated using the Data Needs Matrix (see Table 17). The user of the PEFCR shall apply the DNM to evaluate which data are needed and shall be used within the modelling of its PEF, depending on the level of influence the user of the PEFCR (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.

Figure 7 - Illustrates how to use the DNM

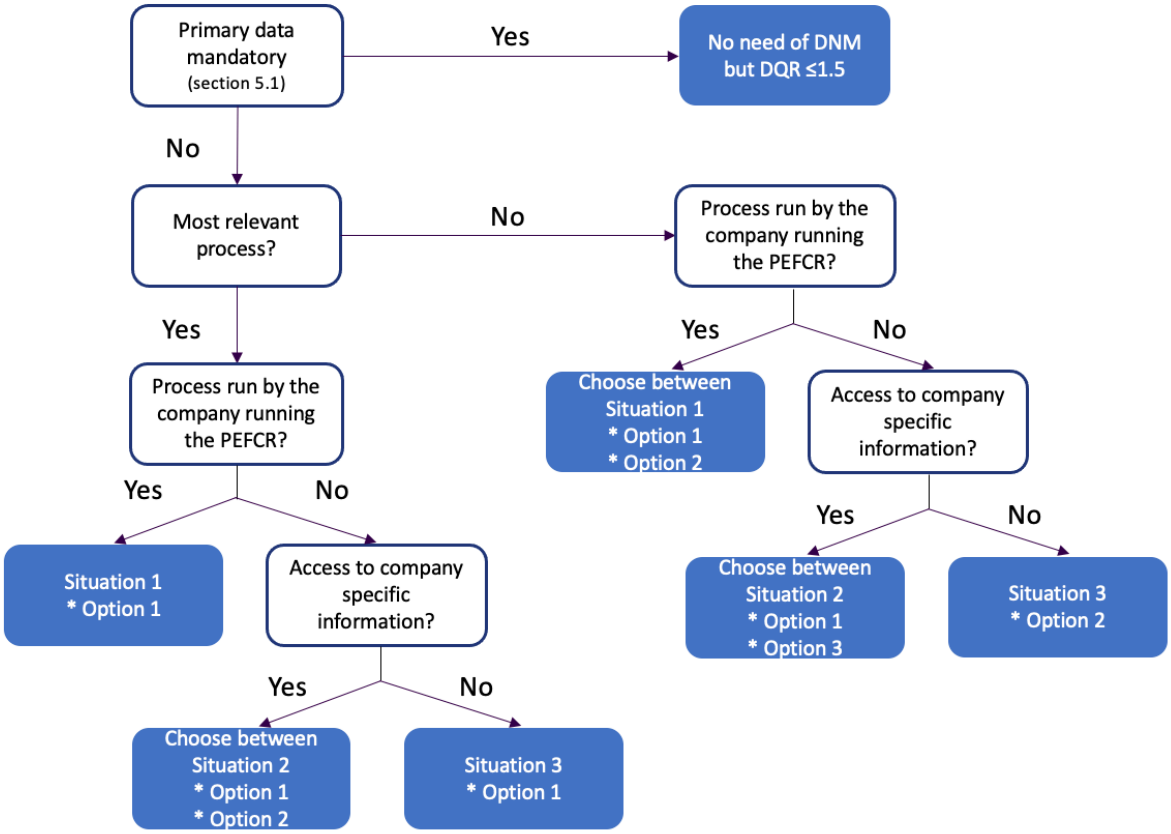

Primary data mandatory (section 5.1)
Yes
No need of DNM but DQR ≤1.5
No
Most relevant process?
No
Process run by the company running the PEFCR?
Yes
Process run by the company running the PEFCR?
Yes
No
Choose between Situation 1 * Option 1 * Option 2
Access to company specific information?
Yes
No
Situation 1 * Option 1
Access to company specific information?
Choose between Situation 2 * Option 1 * Option 3
Situation 3 * Option 2
Yes
No
Choose between Situation 2 * Option 1 * Option 2
Situation 3 * Option 1

Table 17 - Data Needs Matrix (DNM)

| | | Most relevant process | Other process |
|---|---|---|---|
| Situation 1: process run by the company using the PEFCR | Option 1 | Provide company-specific data (as requested in the PEFCR) and create a company-specific dataset, in aggregated form (DQR≤1.5)[24]<br><br>Calculate the DQR values (for each criterion + total) | |
| | Option 2 | | Use default secondary dataset in PEFCR, in aggregated form (DQR≤3.0)<br><br>Use the default DQR values |
| Situation 2: process not run by the company using the PEFCR but with access to company-specific information | Option 1 | Provide company-specific data (as requested in the PEFCR) and create a company-specific dataset, in aggregated form (DQR≤1.5)<br><br>Calculate the DQR values (for each criterion + total) | |
| | Option 2 | Use company-specific activity data for transport (distance), and substitute the sub-processes used for electricity mix and transport with supply-chain specific EF compliant datasets (DQR≤3.0)*<br><br>Re-evaluate the DQR criteria within the product specific context | |
| | Option 3 | | Use company-specific activity data for transport (distance), and substitute the sub-processes used for electricity mix and transport with supply-chain specific EF compliant datasets (DQR≤4.0)*<br><br>Use the default DQR values. |
| Situation 3: process not run by the company using the PEFCR and without access to company- specific information | Option 1 | Use default secondary data set in aggregated form (DQR≤3.0)<br><br>Re-evaluate the DQR criteria within the product specific context | |
| | Option 2 | | Use default secondary data set in aggregated form (DQR≤4.0)<br><br>Use the default DQR values |

*Disaggregated datasets shall be used.

The options described in the DNM are not listed in order of preference.

### 5.4.1 Processes in situation 1

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

[24] Company-specific datasets shall be made available to the EC

- 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 user of the PEFCR applies company-specific data. The DQR of the newly developed dataset shall be evaluated as described in Section 5.3.1

**Situation 1/Option 2**

For the non-most relevant processes only, if the user of the PEFCR decides to model the process without collecting company-specific data, then the user 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 user of the PEFCR shall take the DQR values from the metadata of the original dataset.

### 5.4.2 Processes in situation 2

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

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

**Situation 2/Option 1**

For all processes not run by the company and where the user of the PEFCR applies company- specific data, the DQR of the newly developed dataset shall be evaluated as described in Section 5.3.1

**Situation 2/Option 2**

The user of the PEFCR shall use company-specific activity data for transport and shall substitute the sub-processes used for electricity mix and transport with supply-chain specific PEF compliant datasets, 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.

The user of the PEFCR shall make the DQR context-specific by re-evaluating TeR and TiR using Table 16. The criteria GeR shall be lowered by 30%[25] and the criteria P shall keep the original value.

**Situation 2/Option 3**

The user of the PEFCR shall apply company-specific activity data for transport and shall substitute the sub-processes used for electricity mix and transport with supply-chain specific PEF compliant datasets, 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.

In this case, the user of the PEFCR shall use the default DQR values. If the default dataset to be used for the process is not listed in the PEFCR, the user of the PEFCR shall take the DQR values from the original dataset.

Table 18 - DQR criteria assessment for secondary datasets

| | *TiR* | *TeR* | *GeR* |
|---|---|---|---|
| 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 |

[25] *In situation 2, option 2 it is proposed to lower the parameter GeR by 30% in order to incentivise 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.*

| | TiR | TeR | GeR |
|---|---|---|---|
| 4 | The EF report publication date happens not later than 6 years beyond the time validity of the dataset | The technologies used in the EF study are similar to those included in the scope of the dataset | The process modelled in the EF study takes place in a country that is not included in the geographical region(s) the dataset is valid for, but sufficient similarities are estimated based on expert judgement. |
| 5 | The EF report publication date happens later than 6 years after the time validity of the dataset | The technologies used in the EF study are different from those included in the scope of the dataset | The process modelled in the EF study takes place in a different country than the one the dataset is valid for |

### 5.4.3 Processes in situation 3

If a process is not run by the company using 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).

**Situation 3/Option 1**

In this case, the user of the PEFCR shall make the DQR values of the dataset used context-specific by re-evaluating TeR, TiR and GeR, using the table(s) provided. The criteria P shall keep the original value.

**Situation 3/Option 2**

For the non-most relevant processes, the user of the PEFCR shall apply 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 user of the PEFCR shall take the DQR values from the original dataset.

More concrete examples of how to apply the DNM can be found in ANNEX VIII – Data collection scenarios and examples of the application of the DNM in the context of this PEFCR.

## 5.5 Which datasets to use?

This PEFCR lists the secondary datasets to be applied by the user of the PEFCR. It also gives a guidance on how to deal with data gaps and how to select proxies (see Section

3.8.2). Whenever a dataset needed to calculate the PEF profile is not among those listed in this PEFCR, then the user shall choose between the following options (in hierarchical order):

- Use an EF compliant dataset available on one of the nodes of the Life Cycle Data Network http://eplca.jrc.ec.europa.eu/LCDN/;
- 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 "limitations" section of the PEF report.
- Use an ILCD entry level (EL) compliant dataset. These datasets shall be included in the "limitations" section of the PEF report. A maximum of 10% of the total environmental impact may be derived from ILCD-EL compliant datasets (calculated cumulatively from lowest to largest contribution to the total EF profile).
- If no EF compliant or ILCD-EL compliant proxy is available, it shall be excluded from the PEF study. This shall be clearly stated in the PEF report as a data gap and validated by the PEF study and PEF report verifiers.

## 5.6 How to calculate the average DQR of the study

To calculate the average DQR of the PEF study, the user of the PEFCR shall calculate separately the TeR, TiR, GeR and P for the PEF study as the weighted average of all most relevant processes, based on their relative environmental contribution to the total single overall score. The calculation rules explained in Section 4.6.5.8 of the PEF method shall be used.

## 5.7 Allocation rules

The allocations rules that shall be followed are indicated in Table 19. Default data should be used for life cycle stages 3 (distribution and allocation of transport), 4 (use stage, allocation of washing) and 5 (end of life, allocation of end-of-life treatment), unless primary data are used for LCS3.

Table 19 - Allocation rules

| Process | Allocation rule | Modelling instructions | Allocation factor |
|---|---|---|---|
| **Manufacturing** | | | |
| Spinning | Mass allocation | Industry data shall be modelled at process level. | N/A |
| Sizing | Mass allocation | | |
| Knitting | Mass allocation | | |
| Dyeing | Mass allocation | | |
| Printing | Area allocation | | |
| Finishing | Mass allocation | | |
| Assembly | Unit allocation | | |
| Compound forming | Mass allocation | | |
| Die-cutting | Mass allocation | | |
| In-sole production | Mass allocation | | |
| Sewing | Unit allocation | | |
| Stockfitting | Mass allocation | | |
| **Distribution** | | | |
| All transport processes related to the distribution of the final product to the final client | Mass allocation | The distribution impacts (trucks, vans, etc.) are based on the distance travelled and the mass of the product being transported (tonne-kilometre (tkm)). | N/A |
| Consumer travel | Volume allocation | The impacts from consumer travel (allocation of the car impact) shall be based on volume. | The allocation factor shall be calculated as the volume of the product divided by the maximum volume (0.2$m^3$ for a passenger car). |
| Intermediate storage at warehouse/ distribution centre and retail/ stores | The allocation shall be based on the space (in $m^3$) and time (in weeks) occupied by the representative product. | The impacts of storage shall be based on volume of storage location and product volume, as well as the average storage time. | The allocation factor is calculated as the ratio between the product volume*time and storage capacity volume*time. To adjust for additional space the product takes in the storage facility, a storage volume factor of 4 is used for ambient storage, thus the product volume shall be multiplied by 4 (OEFSRs retail, 2018). |

## 5.8 Electricity modelling

The following electricity mix shall be used in hierarchical order:

- Supplier-specific electricity product shall be used if for a country there is a 100% tracking system in place, or if:
    - available, and

    - the set of minimum criteria to ensure the contractual instruments are reliable is met.
- The supplier-specific total electricity mix shall be used if:
    - available, and
    - the set of minimum criteria to ensure the contractual instruments are reliable is met.
- The 'country-specific residual grid mix, consumption mix' shall be used. Country-specific means the country in which the life cycle stage or activity occurs. This may be an EU country or non-EU country. The residual grid mix prevents double counting with the use of supplier-specific electricity mixes in (a) and (b).
- As a last option, the average EU residual grid mix, consumption mix (EU+EFTA), or region representative residual grid mix, consumption mix, shall be used.

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.

**Set of minimum criteria to ensure contractual instruments from suppliers**

A supplier-specific electricity product/ mix may only be used if the user of the PEF method ensures that the contractual instrument meets the criteria specified below. If contractual instruments do not meet the criteria, then country-specific residual electricity consumption-mix shall be used in the modelling.

The list of criteria below is based on the criteria of the GHG Protocol Scope 2 Guidance[26]. A contractual instrument used for electricity modelling shall:

**Criterion 1 – Convey attributes**

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

**Criterion 2 – Be a unique claim**

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

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

**Modelling 'country-specific residual grid mix, consumption mix':**

Datasets for residual grid mix, consumption mix, per energy type, per country and per voltage are made available by data providers.

If no suitable dataset is available, the following approach should 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 combine 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;

[26] *World Resources Institute (WRI) and World Business Council for Sustainable Development WBCSD (2015): GHG Protocol Scope 2 Guidance. An amendment to the GHG Protocol. Corporate Standard*

- 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 (www.iea.org).

Available LCI datasets per fuel technologies. The LCI datasets available are generally specific to a country or a region in terms of:

- fuel supply (share of resources used, by import and/ or domestic supply);
- energy carrier properties (e.g. element and energy contents);
- technology standards of power plants regarding efficiency, firing technology, flue-gas desulphurisation, NOx removal and de-dusting.

**Allocation rules:**

The allocation rules below shall be followed for life cycle stage 2 (manufacturing). If primary data are used for life cycle stage 3 (distribution), the distribution allocation rules shall be used as well.

Table 20 - Allocation rules for electricity

| Process | Physical relationship | Modelling instructions |
|---|---|---|
| Manufacturing | Mass | The electricity mix used shall be a production-weighted average when data from multiple sites are used. |
| Distribution | Volume | The electricity mix used shall be a volume-weighted average when data from multiple sites are used. |

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:

- If 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.
- If 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.
- If all the products produced in the specific plant are supplied with a publically available PEF study, the company wanting 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.

**On-site electricity generation:**

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 may be seen as a multifunctional situation. The system will provide two functions (e.g. product + electricity) and the following rules shall be followed:

- If possible, apply subdivision. Subdivision applies both to separate electricity productions or to a common electricity production where you may allocate based on electricity amounts the upstream and direct emissions to your own consumption and to the share you sell out of your company (e.g. if a company has a windmill on its production site and exports 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[27].

Subdivision is considered as not possible when upstream impacts or direct emissions are closely related to the product itself.

## 5.9 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 CH4) 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[28] 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 foreground emissions.

Only the emission 'methane (biogenic)' is modelled, while no further biogenic emissions and uptakes from atmosphere are included. If methane emissions can be both fossil or biogenic, the release of biogenic methane shall be modelled first and then the remaining fossil methane.

3. **Climate change – land use and land use change**: This sub-category accounts for carbon uptakes and emissions ($CO_2$, CO and CH4) originating from

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

[28] 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.

carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions). For native forests, all related $CO_2$ emissions are included and modelled under this sub-category (including connected soil emissions, products derived from native forest[29] and residues), while their $CO_2$ uptake is excluded. The emission flows ending with '(land use change)' shall be used.

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 are 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

[29] Following the instantaneous oxidation approach in IPCC 2013 (Chapter 2). 210

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[30].

1. Where it can be demonstrated that the land use change occurred more than 20 years prior to the assessment being carried out, no emissions from land use change should be included in the assessment.
2. Where the timing of land use change cannot be demonstrated to be more than 20 years, or a single harvest period, prior to making the assessment (whichever is the longer), it shall be assumed that the land use change occurred on 1 January of either:

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

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

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);

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

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

Knowledge of the prior land use can be demonstrated using a number of sources of information, such as satellite imagery and land survey data. Where records are not available, local knowledge of prior land use can be used. Countries in which a crop is grown can be determined from import statistics, and a cut-off threshold of not less than 90% of the weight of imports may be applied. Data sources, location and timing of land use change associated with inputs to products shall be reported." [end of quote from PAS 2050:2011]

Soil carbon storage shall not be modelled, calculated and reported as additional environmental information.

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

The sub-category 'Climate change-biogenic' shall be reported separately. The sub-category 'Climate change-land use and land transformation' shall be reported separately.

## 5.10 Modelling of end of life and recycled content

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

### 5.10.1 Circular Footprint formula

The Circular Footprint Formula (CFF) 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. $R_2$ shall therefore take into account the inefficiencies in the collection and recycling (or reuse) processes. $R_2$ 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.

**$E_{ER}$**: specific emissions and resources consumed (per functional unit) arising from the energy recovery process (e.g. incineration with energy recovery, landfill with energy recovery, etc.).

**$E_{SE,heat}$ 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.

**$E_D$**: 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 CFF relies on several parameters which account for: physical characteristics of products sent to recycling (e.g. the material quality after recycling and the heating value of the material); impacts of processes (impact of energy production, recycling and substituted virgin material production); and the market reality for a recycled product.

The **A** factors to be used depend on the recycling pathway and on the material type and are defined in Table 21. For cases not foreseen in Table 21, the **A** factor should be selected according to the latest version of Part C of Annex II of the PEF method.

The **B** factor shall equally be set according to the latest version of Part C of Annex II of the PEF method and is defined as 0 at the time this PEFCR is being written.

The parameters of the CFF are to be defined for each raw material / disposed material and reported and justified in the product footprint report.
In the case of recycling, the $\mathbf{R_2}$, $\mathbf{E_{rec}}$, $\mathbf{E_{recEoL}}$, $\mathbf{E_v}$ and $\mathbf{E^*_v}$ shall be defined for every recycling process.

- The $\mathbf{R_1}$ factor shall be defined as the share of recycled material in each raw material.
- The rate of recycling, $\mathbf{R_2}$, defined for each recycling scenario applicable shall account for the quantity of recycled material effectively produced by the recycling process (accounting for processing loss rates).
- The rate of material sent to energy recuperation, $\mathbf{R_3}$, shall correspond to the rate of product sent to incineration with energy recovery[31] (including the share of product sent to incineration as municipal waste and the share of product collected as used clothing and footwear articles, sorted as non-recyclable and sent to incineration).
- The share of product landfilled or disposed of without energy recovery, equal to 1 – $\mathbf{R_2}$ – $\mathbf{R_3}$, equates to considering by default that the losses of the recycling process[32] are landfilled or disposed of, without energy recovery. If the recycling losses are known to be disposed of otherwise, the end-of-life may be modelled accordingly.
- The quality factor ratios for each substitution, $\frac{Q_{s_{in}}}{Q_p}$ and $\frac{Q_{s_{out}}}{Q_p}$**,** should account for the difference in quality in comparison to the virgin material. In particular, in the case of mechanical recycling, the fibres have a lesser quality than the virgin fibres they would substitute. The nature and unit of the parameter chosen to measure material quality is not defined by the PEF method. Substitution rates or economic values are used for this parameter.

[31] The CFF includes the recuperation of energy from landfills in the $R_3$ term. Since the recuperation of methane emitted from apparel or footwear products in landfill is not known, it is not included in the PEFCR.
[32] This refers to the material losses occurring in the transformation of the recyclable product into recycled material.

- **$E_{rec}$** and **$E_{recEoL}$** shall be defined as the impacts of the collection, sorting, pre-processing, processing and transportation of materials involved in treating materials sent to recycling until their use as recycled materials.
- **$E_v$** and **$E^*_v$** correspond to the impacts of substituted or consumed virgin materials, with the same scope as the factors for recycled materials.
- **$X_{ER,heat}$** and **$X_{ER,elec}$**, **$E_{SE,heat}$**, **$E_{SE,elec}$** and **$E_D$** shall be defined according to the practices and electricity mixes in the applicable geographical zone where the product is disposed of.

### 5.10.2 Recycled content

The following part of the Circular Footprint Formula is used to model the recycled content:

$$(1 - R_1)E_v + R_1(AE_{recycled} + (1 - A)E_v \frac{Q_{sin}}{Q_p})$$

The $R_1$ values applied shall be supply-chain specific or $R_1$=0 should be used as default, in relation with the DNM. Material-specific values based on supply market statistics are not accepted as a proxy and therefore shall not be used. The applied R1 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 guidelines shall be followed when using supply-chain specific $R_1$ values:

- The supplier information (through e.g. statement of conformity or delivery note) shall be maintained during all stages of production and delivery at the converter;
- Once the material is delivered to the converter for production of the end products, the converter shall handle information through their regular administrative procedures;
- The converter for production of the end products claiming recycled content shall demonstrate through its 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 may be applied as long as they cover the general guidelines outlined above.

According to the PEF method (Section 4.4.8.6.), the default value for $R_1$ is 0%. This is also in line with a study on the European market on the potential for recycled fashion from the Confederation of British Industry (2020), which shows that the use of recycled apparel and footwear products is still negligible. Traceability for a specific $R_1$ must be from recycling plant down to the point of sale, with a valid and trustworthy chain of custody system and a verification by a third-party body.

The default parameters for raw materials in the CFF are defined in Table 21. Depending on the fibre or material type used as secondary product, the table indicates the $E_v$ to be chosen, the scope of $E_{rec}$, as well as the parameters A and $Q_{sin}/Q_p$ to be introduced in the formula. It shall be noted that the scope of $E_{rec}$ doesn't specify in detail all necessary steps to transform the waste input into the secondary material. The user of this PEFCR shall make sure to include them.

For pathways marked with an asterisk (*), there was too little evidence for defining $Q_{sin}/Q_p$ for these pathways at the time this PEFCR was written. The user of the PEFCR shall determine them according to Section 4.4.8.5 of the PEF method.

Table 21 - Definition of the CFF parameters for the raw materials

| Fiber or material type | Scope for Ev | Flow of recycled material | Origin of recycled material | A | Qsin/Qp | Erec |
|---|---|---|---|---|---|---|
| Synthetic polyester | Production of virgin polyester fibres | Recycled polyester fibres | PET bottles | 0.5 | 1 | Impacts of collection, sorting and recycling PET bottles into polyester fibres |
| | | | Textile PET fibres (via mechanical recycling) | 0.8 | 0.75 | Impacts of collection, sorting, clothes preparation for recycling, shredding and recycling textile PET fibres into polyester fibres |
| | | | Recyclate PET from textile (via chemical recycling) | 0.8 | 1 | Impacts of collection, sorting, clothes preparation for recycling and chemical recycling of polyester fibres from textile sources |
| Synthetic (polyester excluded) | Production of virgin synthetic fibres | Recycled synthetic fibers | Textile synthetic fibres | 0.8 | 0.75 | Impacts of collection, sorting, clothes preparation for recycling, shredding and recycling textile synthetic fibres into fibres |
| | | | Recyclate polymer from textile | 0.8 | 1 | Impacts of collection, sorting, clothes preparation for recycling and chemical recycling of polyester fibres from textile sources |
| Natural fibres | Production of cellulosic virgin fibres | Recycled cellulosic fibres | Textile product | 0.8 | 0.5 | Impacts of collection, sorting, clothes preparation for recycling shredding of textiles and recycling into recycled cellulosic fibres |
| | Production of virgin clean wool | Recycled wool | Textile product | 0.8 | 0.65 | Impacts of collection, sorting, clothes preparation for recycling shredding of textiles and recycling into recycled wool fibres |
| Footwear materials | Production of virgin rubber | Recycled rubber | Other feedstock | 0.5 | 0.75 | Impacts of collection, sorting, shredding and recycling into recycled rubber |
| | | | Footwear | 0.5 | To be defined* | Impacts of collection, sorting, shredding of used footwear and recycling into recycled rubber |
| | Production of virgin polymer | Recycled polymer | Other feedstock | 0.5 | 0.9 | Impacts of collection, sorting, shredding and recycling into recycled polymer |
| | | | Footwear | 0.5 | To be defined* | Impacts of collection, sorting, shredding of used footwear and recycling into recycled polymer |
| | Production of virgin foam | Recycled foam | Other feedstock | 0.5 | 0.75 | Impacts of collection, sorting, shredding and recycling into recycled foam |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Footwear | 0.5 | To be defined* | Impacts of collection, sorting, shredding of used footwear and recycling into recycled foam |
| Leftover fabrics | Production of the virgin fabric | Leftover fabric | Manufacturing leftovers | 0.8 | 1 | Impacts of collection, sorting and preparing leftovers for recycling (to be defined by the user of the PEFCR) |

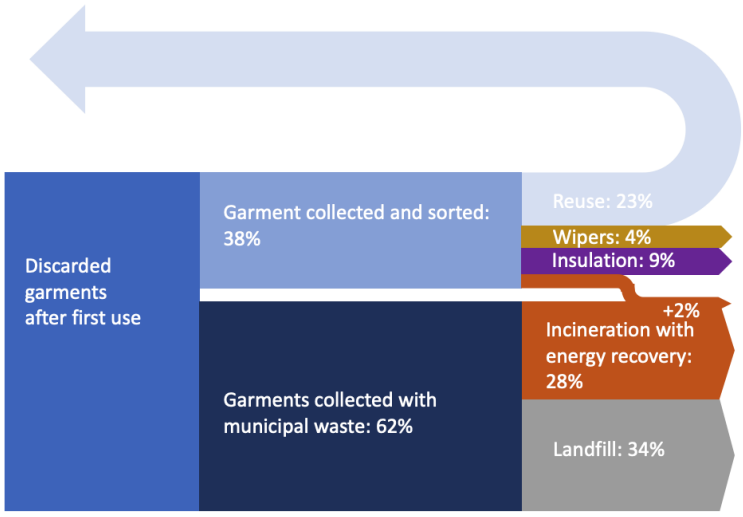
*Guidance on the definition of Qsin and Qsout can be found in the PEF method in Section 4.4.8.5.

According to the PEF Method, the $Q_{Sout}/Q_p$ and $Q_{Sin}/Q_p$ ratios are capped at 1. The ratios are relevant if the substituted primary material and the recycled material are similar materials. In cases where the recycled material substitutes a different material, the quality ratio is set as 1 and the difference in the quantity of material used shall be accounted in the $E^*_v$ parameter. The $E^*_v$ parameter shall be scoped for the quantity of virgin material needed to fulfil the same function as the quantity of recycled material (see also Table 22).

### 5.10.3 End-of-life scenarios

Figure 8 details the general post-consumer scenario rates. These scenarios and the corresponding $R_2$ and $R_3$ values presented in Figure 8 and Table 22 are from the Synthesis of the Environmental Assessment of the Value Chain of Used Textiles (RDC Environment and EcoTLC, 2019), with the added assumption that materials recycled as insulation replace mineral wool. R2 values do not apply for pathways with a recyclability disruptor (Table 24 to Table 26).

Figure 8 - Post-consumer apparel scenarios & definition of R2 and R3 parameters for the CFF




R2 = Recycling or reuse; R3 = Energy Recovery

| Status in CFF Formula | Rate of End-Of-Life scenario (excluding reuse) |
|---|---|
| R2_Wipers | 5% |
| R2_Insulation | 12% |
| R3 | 39% |
| 1 – R2 – R3 | 44% |

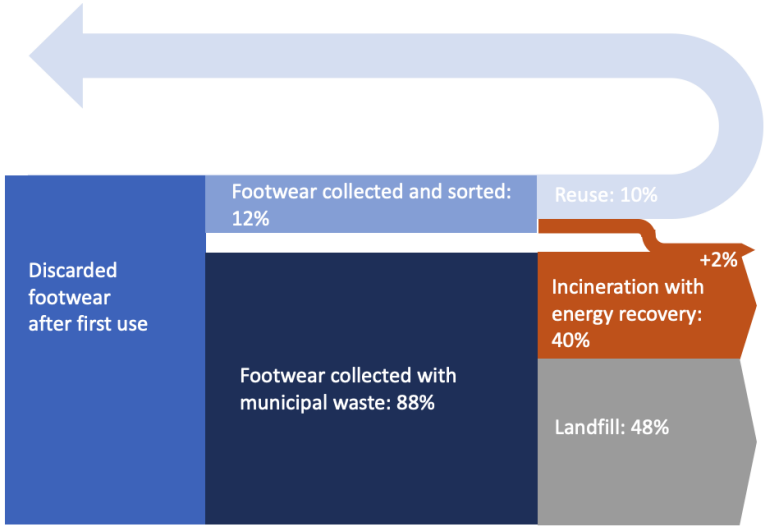
For footwear, as detailed in Figure 9, it is difficult to find statistics on recycling[33], which is thus assumed to be negligible. A 12% collection rate and a 10% reuse rate[34] are

[33] Better Shoe Foundation, http://www.bettershoes.org/home/post-consumer-life, last accessed 2021/01/12

[34] EcoTLC (Refashion), 2019, Roads to innovation, https://refashion.fr/pro/sites/default/files/fichiers/Chemins-Innovation2019_EN_BD.pdf) (accessed 2021/17/02)

used, the European rate of landfill / incineration (Part C of Annex II, PEF method) with energy recovery is applied to the 88% of footwear disposed with municipal waste.

Figure 9 - Post-consumer footwear scenarios & definition of R2 and R3 parameters for the CFF




| Status in CFF Formula | Rate of End-Of-Life scenario (excluding reuse) |
|---|---|
| R2 | 0% |
| R3 | 46% |
| 1 – R2 – R3 | 54% |

R2 = Recycling or reuse; R3 = Energy Recovery

The percentages shown in Figure 8 and Figure 9 are scaled to 100% excluding the reuse share. The general parameters for end-of-life in the CFF are defined in Table 22 and Table 23, references for these parameters are listed in the paragraphs above (the A factor is defined in Table 21). For the end of life of trims, the corresponding waste management datasets for the incineration and landfill scenarios of the same materials shall be used. For the recycling scenario, the end-of-life treatment of trims is considered to be included in the recycling process for the wipers and insulation scenarios. In case company-specific datasets representing the textile-to-textile recycling pathway are developed, the specific waste treatment of trims (e.g. recycled, incinerated or landfilled) shall be considered, and the defined $R_2$ shall take into account the losses through trim separation where relevant.

Table 22 - Definition of the CFF parameters for the end-of-life for apparel

| Recycling pathway | Scope for $E^*_v$ | $R_2$ for pathway | $Q_{Sout}/Q_p$ | $E_{rec}$ | $R_3$ |
|---|---|---|---|---|---|
| *Mechanical recycling* | | | | | |
| Wipers | Production of wipers from virgin cotton | 5% | 0.3[35], | Collection, sorting, clothes preparation for recycling and production of wipers from used clothes | *39 %* |
| Insulation | Production of virgin mineral wool | 12% | 1[36] | Collection, sorting, clothes preparation for recycling and production of insulation from used clothes | |
| Apparel | Virgin fibres (which are replaced) | 0% | 0.5[37] | Collection, sorting, clothes preparation for recycling and production of recycled fibres through mechanical recycling | |
| | *Total:* | ***17%*** | | | |
| *Chemical recycling* | | | | | |
| Apparel and other applications | Virgin synthetic fibres | 0% | 1[38] | Collection, sorting, clothes preparation for recycling, production of recycled fibres through chemical recycling | *39 %* |
| | Virgin manmade cellulosics | 0% | 0.5[39] | | |
| | *Total:* | ***0%*** | | | |

Table 23 - Definition of the CFF parameters for the end-of-life for shoes

| Recycling pathway | Scope for $E^*_v$ | $R_2$ for pathway | $Q_{Sout}/Q_p$ | $E_{rec}$ | $R_3$ |
|---|---|---|---|---|---|
| Footwear | Thermoplastic material | 0% | 0.9 | Collection, sorting, preparation of shoes for recycling, grinding and extrusion | *46%* |
| | PU foam and other reticulated materials | 0% | 0.9 | Collection, sorting, preparation of shoes for recycling, recycling process | |
| | *Total:* | ***0%*** | | | |

[35] Based on prices from MSC Industrial Direct, this ratio goes from 0.2 for jean-based rags, to 0.5 for good state white t-shirt-based rags, with mixed reclaimed wipers having a ratio of 0.3. Considering most garments are reused in the European context, the value recommended is 0.3.

[36] Mineral wool has a lower insulation quality. As per the PEF Method 2021 (p.52), the quality ratio is set to 1

[37] Expert opinion extrapolated from case studies. This includes the loss of short fibres in the process.

[38] Chemically recycled synthetic fibres are assumed to have the same characteristics as virgin fibres.

[39] Expert opinion extrapolated from case studies. This includes the loss of short fibres in the process.

### 5.10.3 Calculation of R2 and recyclability disruptors

In case a recycling scenario is not covered in this PEFCR (either in Table 22 to Table 26 or in Section 5.10 above), the PEF method (Section 4.4.8.9) provides additional information on the recycling output rate ($R_2$ value).

The product design and composition will determine if the material in the specific product is actually suitable for recycling. Therefore, before selecting the appropriate $R_2$ value, an evaluation of the recyclability of the material shall be made and the PEF study shall include a statement on the recyclability of the materials/ products:
The statement on recyclability shall be provided together with an evaluation for recyclability that includes evidence for the following three criteria (as described by ISO 14021:2016, 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. For PET bottles the EPBP guidelines should be used (https://www.epbp.org/design-guidelines), while for generic plastics the recyclability by design should be used (www.recoup.org).

If one criterion is not fulfilled, or the sector-specific recyclability guidelines indicate limited recyclability, an $R_2$ value of 0% shall be applied. Point 1 and 3 may be proven by recycling statistics (country specific) derived from industry associations or national bodies. Approximation to evidence at point 3 may 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.
Default application-specific $R_2$ values are available in Annex C. The following procedure shall be followed to select the $R_2$ value to be used in a PEF study:

- Company-specific values shall be used when available and following the evaluation of recyclability.
- If no company-specific values are available and the criteria for the evaluation of recyclability are fulfilled (see above), application-specific $R_2$ values shall be used selecting the appropriate value available in Annex C:

- If an $R_2$ value is not available for a specific country, then the European average shall be used;
- If an $R_2$ value is not available for a specific application, the $R_2$ values of the material shall be used (e.g. materials' average);
- In case no $R_2$ values are available, $R_2$ shall be set equal to 0 or new statistics may be generated in order to assign an $R_2$ value in the specific situation.

The applied $R_2$ values shall be subject to the PEF study verification.
Background information to calculate the $R_2$ values for packaging materials is available in Annex C of the PEF Method.

**Collection period for $R_2$:** Annual administrative period as a basis for the data collection.

For both garments and footwear, the user may use case-specific data to model end-of-life scenarios such as composting, mechanical or chemical recycling.

Recyclability disruptors are components or characteristics of the apparel or footwear product which will hinder recyclability and therefore induce a factor $R_2$=0. Indeed, the product composition and design as well as its finishing, applications and printing affect its recyclability. Accordingly, for this type of recycling stream, the second part of the formula for "Material" will be equal to 0. The occurrence of a single disruptor is sufficient to lead to a value of 0. Recyclability disruptors and the corresponding $R_2$ values for specific pathways are listed in Table 24 to Table 26. These tables aim to:

- Identify disruptors, which should prevent a product which is clearly not recyclable getting credits from recycling (by setting $R_2 = 0$ for these cases)
- Provide information and guidance for the industry to develop more recyclable products. While textile-to-textile or footwear-to-footwear pathways are not considered in the default pathways of this PEFCR, the information on disruptors was deemed useful by the TS

These tables shall be read at product level. Any disruptor on a product/component leads to an $R_2 = 0$ value for the entire product. These tables will have to be updated in the next version of the PEFCR to ensure that they correctly reflect the evolving technologies and their requirements.

Table 24 - Recyclability disruptors and corresponding $R_2$ values for wiper and insulation pathways (apparel)

| Product type | Main disruptors | $R_2$ (wiper pathway) | $R_2$ (insulation pathway) |
|---|---|---|---|
| Apparel | Less than 80% cotton | 0 | Default $R_2$ |
| | Products with more than 5% elastane | Default $R_2$ | 0 |
| | Coating, flocking, imprint, glue | | |
| | Products with electrical and electronic equipment | 0 | 0 |
| | Products with metallic fibres | | |
| | Multicomposition of the textile part (>2 materials) | | |
| | Particular knitting (jacquard, warp) | 0 | Default $R_2$ |

Table 25 - Recyclability disruptors and corresponding R2 values for textile-to-textile pathways (mechanical and chemical)

| Recycling main steps | Disruptors | $R_2$ - Textile to textile pathway - Mechanical recycling | $R_2$ - Textile to textile pathway - thermomechanical recycling | $R_2$ - Textile to textile pathway - Chemical recycling |
|---|---|---|---|---|
| Global | Products with electrical and electronic equipment | 0 | 0 | 0 |
| Sorting / dismantling (Feedstock preparation) | Multicomposition of the textile part (>2 materials)** | 0 | 0 | 0 |
| Recycling | Less than 90% cotton at product level | 0 | 0 | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Less than 50% wool at product level | 0 | 0 | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Less than 90% linen / hemp / silk at product level | 0 | 0 | 0 |
| | Less than 85% polyester / nylon at product level *** | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* | | |
| | More than 5% of elasthane at product level*** | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* | | |
| | All over prints | 0 | 0 | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Placed prints ≥ 10 cm² | 0 | 0 | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Coatings**** | 0 | 0 | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Lamination**** | 0 | 0 | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Adhesives | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* | | |
| | Products with metallic fibers | 0 | 0 | 0 |
| | Products with hard embellishments | 0 | 0 | 0 |

* verifiable evidence of recyclability is detailed in subsequent paragraph

** Current development shows that a maximum of 2 spectra are required for good near infrared sorting performance

*** Mechanical recycling is possible but can generate esthetic problematics after regeneration and dyeing as the dye will only be fixed on polyester and not on cotton/elasthane. Recycling of a garment with less than 85% polyester / nylon or more than 5% of elasthane is possible if there are no issues on the esthetic perception.

**** *Lamination* consists of bonding pre-prepared polymer film or membrane with one or more textile substrates using adhesives, heat, or pressure. *Coating* is the process of applying a viscous liquid (fluid) or formulated compound on a textile substrate.

Table 26 - Recyclability disruptors and corresponding $R_2$ values for closed mid and low shoes

| Recycling main steps | Disruptors | R2 - Closed mid and low shoes |
|---|---|---|
| Global | Products with electrical and electronic equipment | 0 |
| Dismantling (upper sole separation) | Foam midsole | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Sewn assembly | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Open-toe shoe | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| Shredding | Metal hard points | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Elastane > 5% - upper | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Inserts in the sole (wood, composite materials, metal, non elasthomere plastics) | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| Oversorting | Density difference < 0,2g / $cm^3$ between materials that are not compatible | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Laminated component - Upper | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Coated component - Upper | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Glued component - Upper | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| | Overmolded component - Upper | For these characteristics, verifiable evidence of recyclability must be provided for using R2 >0* |
| Recycling | Flame retardants | 0 |

* verifiable evidence of recyclability is detailed in subsequent paragraph

Verifiable evidence of recyclability in case of products containing an identified disruptor should meet the above 3 criteria from the PEF method, with additional requirements:

1. Specific collection and/or sorting system which overcomes the issue of the disruptor.
2. Specific infrastructure which allows for the dismantling and recycling of products with such disruptors.
3. The sorting and recycling infrastructures shall justify that the type of concerned products is indeed collected, sorted and recycled at industrial scale (and not lab scale).

# 6 Life cycle stages

This section provides guidance on the modelling of the different life cycle stages.

Should the user of the PEFCR wish to use company-specific data to replace the default data provided in this Section, the company-specific data shall be as representative of the product as possible (e.g., if the product is produced over three months of the year, primary data should be representative of these three months). Company-specific data shall follow the same approach as the one used to define the default data it replaces (e.g. energy consumption for the storage of products shall be based on the volume of the product and where it is stored, as well as the time spent in storage) or any other approach equally or more accurate. In any case, the DQR of the data/processes shall be calculated accordingly and comply with the PEFCR requirement (see section 5.3.1). In case of no exact match (type of material, technology of process, geographic representativeness, etc.) between the dataset and the system modelled, guidance is provided in Section 3.8.2.3 to help the user of the PEFCR find the best proxy.
The default datasets to use to model transportation modes, packaging, use phases and end of life are available in ANNEX VII – Inventory modelling and default datasets ("Default datasets & DQR" tab).

## 6.1 Raw materials acquisition and pre-processing

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

The raw materials acquisition and pre-processing life cycle stage includes the processes starting with the extraction of the resources up to the gate of the material's production facility or pre-processing plant, according to Table 10. The raw materials acquisition and the pre-processing stages are considered to be most relevant life cycle stages for all product sub-categories and thus shall be included for all PEF studies (PEF method).

This life cycle stage usually includes the extraction and processing of fibres. The following production, pre-processing and transport processes are included in the raw materials datasets provided in the most recent version of the EF database:

- Mining, extraction, and refining of resources (e.g. including raw oil);
- Pre-processing of all material inputs to the studied product, including recycled materials;
- Agricultural and forestry activities;
- Transportation within and between extraction and pre-processing facilities, and to the component's production facility (manufacturing plant) according to Table 10; and
- Packaging production.

The PEF study report shall provide a table starting from the final product weight and identifying all upstream losses, either based on company-specific data or on default data, until the gross amount of raw materials needed for the product, calculated according to the guidance in sections 6.1.1 and 6.1.2. The table should include following columns:

- Unique component of BOM
- Life cycle stage
- Process step
- Input value with unit
- Losses with unit
- Source of loss rate (default data, company-specific data)

### 6.1.1 Raw materials and unsold consumer products

Unsold consumer products, like losses, decrease the efficiency of the supply chain and therefore shall be included in the modelling. They will not only affect the amount of raw materials needed for one final garment at the consumer, but will also generate additional amounts processed and transported. Unsold consumer products are defined as "any consumer product that has not been sold including surplus, excessive inventory, overstock and deadstock, including products returned by a consumer in view of their right of withdrawal in accordance with Article 9 of Directive (EU) 2011/83/EU, or, where applicable, during any longer withdrawal period provided by

the trader", as defined in Ecodesign for Sustainable Products Regulation (ESPR) compromise text, published on 19 December 2023[40][41]. It shall **include**:

- Surplus, excessive inventory, overstock and deadstock at any point of the distribution scheme;
- Defective products only once they have reached the brand's distribution scheme;
- Product returns by consumer in view of their right of withdrawal in accordance with Article 9 of Directive (EU) 2011/83/EU.

It shall **exclude** :

- Prototypes;
- Samples;
- Manufacturing leftovers (e.g. deadstock fabrics);
- Manufacturing losses;
- Defective products in manufacturing, before reaching the brand's distribution scheme;
- Resale (e.g. Through outlets, wholesalers).

Items that could not be sold are defined as items that have either been written off from the company's inventory or have remained in stock in a warehouse for more than 3 annual administration periods.

Unsold consumer products shall be accounted for in the following life cycle stages:

- LCS 1 – raw materials acquisition and processing
- LCS 2 – manufacturing
- LCS 3 – distribution
- LCS 5 – end-of-life

[40] The ESPR definition should be applied to qualify unsold consumer products and may be updated if further precision is provided by the Implementing or Delegated Act adopted by the Commission. Its scope is therefore to include all consumer product fit for sale that were not sold, with the following interpretation.

[41] For guidance, Article 20 1 c) refers to management modes on unsold consumer products as ::"whether directly or through a third party, to each of the following activities preparing for re use, remanufacturing, recycling, other recovery including energy recovery and disposal operations in accordance with the waste hierarchy as defined by Article 4 of Directive 2008 98 /EC

The average unsold consumer products rate of the last three administration periods for the product sub-category shall be used, or if not available, at product category level (apparel and footwear).

In the raw materials acquisition and pre-processing stage, unsold consumer products and all other losses (distribution losses, manufacturing losses, manufacturing leftovers, etc.) shall be used as a direct multiplier of the input of raw materials as reported in Section 6.1.2. The end of life of unsold consumer products shall take place in LCS5. The end of life of unsold consumer products shall be modelled according to the product's end of life (Section 5.10), unless primary data are used.

### 6.1.2 Amount of raw materials

The amount of raw materials needed to create one product shall take into account all the losses that occur throughout the product's life cycle (pre-processing losses, manufacturing leftovers, manufacturing losses (including assembly losses), unsold consumer products and distribution losses).

This means that each pre-processing and manufacturing process must be disaggregated in single steps, including specific losses for each step. Only if a new, complete EF dataset of the aggregated manufacturing processes is created, then a global loss rate can be applied. More information on pre-processing and manufacturing losses is available in Section 6.1.2.1 and Section 6.2.1.1.

For each raw material, the relevant amount shall be calculated using Equation 21.

$$RawMat = mBOM * \left( \prod_{i=1}^{NPrePro} (1 + PreProLoss_i) \right) * (1 + ManuLeft) * \left( \prod_{j=1}^{NManuPro} (1 + ManuLoss_j) \right) * (1 + UnsoldProducts) * (1 + DistribLoss)$$

Equation 21

with the following parameters:

- $RawMat$ : is the total mass of the raw material produced (kg).
- $mBOM$: is the mass of the raw material in the BOM based on grading as defined in Section 3.3.1 (kg).

- $PreProLoss_i$: is the fraction of the raw material lost during pre-processing step *i*, and $NprePro$ is the number of pre-processing steps. If the material goes through one pre-processing step only, $NprePro$ = 1 and the equation considers only $PreProLoss_1$. If $NprePro > 1$, the product of (1+ $PreProLoss_i$) is made for each pre-processing step *i* to obtain the total losses for all *NprePro* pre-processessing steps (%). The losses for each specific pre-processing step as specified in the single datasets shall be considered unless specific data are available.
- ***ManuLeft***.: is the fraction of the raw material lost through manufacturing leftovers (%).
- $ManuLoss_i$: is the fraction of the raw material lost during manufacturing process j, and *NmanuPro* is the number of manufacturing processes. If the material goes through one manufacturing process only, *NmanuPro* = 1 and the equation considers only *ManuLoss1.* If *NmanuPro* > 1, the product of (1+ *ManuLossj*) is made for each manufacturing process *j* to obtain the total losses for all *NmanuPro* manufacturing processes (%). The losses for each specific manufacturing process as specified in the single datasets shall be considered.
- ***UnsoldProducts***: is the fraction of the raw material used to create unsold consumer products (see Section 6.3 for more details).
- ***DistribLoss***: is the fraction of the raw material lost through distribution losses (see Section 6.3 for more details)

Note: Equation 21 is used for the calculation of the amounts at each step of the manufacturing chain to select the correct value per processing dataset by deleting the term $(\prod_{i=1}^{NPrePro}(1 + PreProLoss_i))$ – see Equation 25.

In case manual processes are used, the user of the PEFCR shall consider material losses.

Equation 21 shall be fully or partially applied depending on the mass that shall be calculated:

- Case 1: It shall be fully applied to calculate the amount of unprocessed raw material required.

- Case 2: It shall be applied up to the pre-processing step assessed ($PreProLoss_i$) to calculate the amount of partially pre-processed raw material.
- Case 3: It shall be applied without pre-processing losses to calculate the mass of raw material transported (Section 6.1.6).

To illustrate for a skirt with the following parameters:

- mBOM weighs 150g;
- The raw material goes through two LCS1 pre-processing steps with the following pre-processing losses, $\mathrm{PreProLoss1}$ = 3%; $\mathrm{PreProLoss2}$ = 1%;
- The material goes through three LCS2 processes with the following losses $ManuLoss\ 1$ = 1%; $ManuLoss\ 2$ = 5%, $ManuLoss\ 3$ = 8%;
- 10% manufacturing leftovers are created, $ManuLeft.$ = 10%;
- 12% of products remain unsold to consumers $\mathrm{UnsoldProducts}$ = 12%
- And losses during distribution are $DistribLoss$ = 1%.

**The mass of unprocessed raw materials** to produce is:

0.15 * **[**(1+0.03)*(1+0.01)**]** * (1+0.10) * **[**(1+0.01)*(1+0.05)*(1+0.08)**]** * (1+0.12) * (1+0.01) = 0.222 kg of raw material.

In case multiple parts of the product are made of the same material but not going through the exact same pre-processing steps, the calculation for that raw material shall be done for each series of pre-processing steps, and the results summed up at the end.

**The mass of pre-processed raw material** getting out of pre-processing step 1 is:

0.15 * **[**(1+0.01)**]** * (1+0.10) * **[**(1+0.01)*(1+0.05)*(1+0.08)**]** * (1+0.12) * (1+0.01) = 0.216 kg of raw material.

**The mass of pre-processed raw material** to use for the calculation of the raw material distribution (Section 6.1.6) is:

0.15 (1+0.10) * **[**(1+0.01)*(1+0.05)*(1+0.08)**]** * (1+0.12) * (1+0.01) = 0.214 kg of raw material.

#### 6.1.2.1 Pre-processing losses

For raw materials pre-processing losses, the input and output amounts shall be calculated based on the bill of materials according to Section 6.1.2. Pre-processing losses shall be understood as the waste produced during a pre-processing step.

If no company-specific information is available for the losses associated to a pre-processing step, the default loss rate documented in the EF dataset shall be used. If the dataset documentation is unclear, or if the loss rate isn't documented, a default loss rate of 15% shall be used (Quantis expertise). The end of life of these losses shall be considered in LCS1 according to the CFF (Section 5.10).
The following hypothesis shall be considered: the amount of input material for process *n* is equal to the amount of output material for process *n-1* (T-shirt PEFCR, 2019).

Therefore, the output material and the processing losses can be used to calculate the amount of input raw material. Equation 22 shall be used to determine the amount of input material:

$$Amount\ of\ input\ material_n = Amount\ of\ output\ material_n + Waste_n = Amount\ of\ output\ material_n * (1 + LossRate_n)$$

Equation 22

Where the input and output are measured in kg and the waste is measured as a percentage. For example, assuming that the pre-processing step *n* produces 15% waste, 1 kg of pre-processed cotton requires 1.15 kg of cotton from process step *n*-1 according to Equation 22 above.

#### 6.1.2.2 Humidity variations

In case there is a variation of humidity between the input and output and that the data are available, the previous results shall be scaled-up. Equation 23 provides guidelines on how to make the adaptation.

$$Facor\ of\ adaptation = \frac{(1 - Humidity\ out_n)}{(1 - Humidity\ in_n)}$$

Equation 23

To illustrate, for the same pre-processing step with a 15% loss rate, if the pre-processed cotton has a 5% humidity content, and the humidity of the cotton at step *n*-

*1* is 8%, 1 kg of pre-processed cotton will not require 1.18 kg of cotton from process step *n-1* but 1.18 * (1-5%) / (1-8%) = 1.22 kg.

One last calculation step occurs when choosing a dataset to model the inventory of the process step *n-1* with a different humidity content to the one of the input of process *n*. In this case the factor shall be adapted according to Equation 24.

$$Facor\ of\ adaptation = \frac{(1 - Humidity\ reported\ in\ the\ dataset_{n-1})}{(1 - Humidity\ desired_n)}$$

Equation 24

If the humidity of the dataset for process step *n-1* is 10% although the actual humidity of the input of process *n* is 8%, the dataset shall be scaled with a factor of 1.22 * (1-10%)/(1-8%) = 1.19 to model the inventory. If no information is available for the humidity of the output of the dataset for process *n-1*, it shall be considered as equal to the one of process step *n*.

### 6.1.3 Production of raw materials

For both apparel and footwear products, the following processes shall be considered:

- Production of raw textile materials (plant-based and synthetic);
- Production of fibrous and non-fibrous animal-based materials;
- Trims production;
- Packaging materials production and processing; and
- Transportation between the extraction and pre-processing facilities and to the production facility (manufacturing plant).

In background EF-compliant datasets of products derived from native forest, the meta-data either indicate the LUC emissions calculated, or indicate the carbon content of the product and that corresponding LUC emissions that shall be integrated in the study shall be modelled with '(land use change)' elementary flows. For non-compliant datasets from another database or that were created for the specific PEF, LUC must be modelled as described in the PEF method.

### 6.1.4 Circularity of raw materials

Circularity of raw materials is addressed in the following two cases:

- The apparel or footwear product uses recycled materials, which can be of textile or non-textile origin; or
- The apparel or footwear product is recycled after use; this includes recycling apparel and footwear into raw materials for chemicals or other materials such as rubber, plastic, composites, etc.

In these two cases, the credits and impacts associated to these flows are modelled and allocated to the raw material using the Circular Footprint Formula (CFF), presented in detail in Section 5.10. Additional details regarding the CFF are described in Section 4.4.8.1 of the PEF method.

### 6.1.5 Packaging production and distribution

Different packaging types need to be produced to ensure safe shipping and storage of:
- Raw materials, semi-finished & intermediate products; and
- Apparel and footwear products.

If the packaging of raw materials, semi-finished & intermediate products is already considered in the EF datasets used for the study, it shall not be modelled separately to prevent double counting. If the packaging isn't included in the dataset, or if the documentation of the dataset is unclear, packaging shall be modelled as described below, even if it may lead to double counting.
Packaging materials may include recycled material. The company shall use the default R1 parameter in the latest version of Part C of Annex II of the PEF method, unless primary data are used.

#### 6.1.5.1 Transport of packaging

It is assumed that all packaging comes from the same continent as the plant where it is used, unless primary data are used. The transportation modes listed below are additive.

Packaging transport is assumed to be weight-limited for all packaging types. The default parameters (from the PEF method) for packaging transport in Table 27 below shall be used unless primary data are used. These parameters shall also be used to model the return of reusable packaging such as pallets, unless primary data are used.

Table 27 - Default transport parameters for all packaging materials

| Supply chain | Distance (km) | Utilisation ratio | Share of product mass transported (%) | Transportation mode |
|---|---|---|---|---|
| Supplier located within the continent of the manufacturing plant | 230 | 64% | 100% | Truck (>32 t, EURO 4) |
| | 280 | n/a | | Train (average freight train) |
| | 360 | n/a | | Ship (barge) |

#### 6.1.5.2 Raw materials' packaging

Raw materials' packaging is excluded from the system boundaries (see Section 3.4 for more information).

#### 6.1.5.3 Semi-finished & intermediate products' packaging

Unless primary data are used, the default packaging amounts and materials reported in Table 28 shall be used, based on secondary and tertiary packaging of apparel and footwear products divided by the average RP weight and a volume factor of 4 to account for transport volume inefficiencies (proxy based on ambient volume storage volume factor, OEFSR Retail, 2018). If a dataset already contains packaging, 10% of the default quantities shall be removed for each process (up to 100% if all datasets contain packaging). If it is unclear whether the dataset contains packaging or not, it shall be assumed that packaging is not included.

Table 28 - Default packaging materials per kilogram of semi-finished and intermediate product transported

| Packaging | Mass kg/kg semi-finished and intermediate products | Material |
|---|---|---|
| Corrugated cardboard | 0.040 | Corrugated cardboard |
| Pallets | 0.00002* | Pallets |
| Shrink film | 0.001 | Shrink film |

* including default reuse factor (PEF method, 2021, 4.4.9.5 Average reuse rates for third party operated pools).

The default pallet mass value shall be used to account for the production impact of the pallets, but it shall be multiplied by the default reuse factor to obtain the total weight necessary to calculate the transport impact for one product as calculated in Table 28.

The total mass of semi-finished & intermediate products transported shall be calculated at the gate of the assembly step as explained in Section 6.2.1.

The end of life of the semi-finished & intermediate products packaging shall be accounted for in LCS2. Packaging circularity is discussed in Section 6.1.5.5.

#### 6.1.5.4 Apparel and footwear products packaging

Three kinds of packaging (primary, secondary and tertiary) shall be differentiated as follows:

- **Primary packaging**: Material that immediately covers the product. For example, primary packaging can consist of a plastic film or bag, or paper wrapping. The hangtag is also considered to be primary packaging as well as cellulose paper for footwear.
- **Secondary packaging**: Packaging or containment of a primary package. Packaging for multiple products and their labels are also considered to be secondary packaging.
- **Tertiary packaging**: Packaging conceived to facilitate handling and transport of a number of sales units, or grouped packaging to prevent physical handling and transport damage.

Unless primary data are used, the default packaging materials per different business scenarios (Figure 10) reported in Table 29, Table 30 and Table 31 shall be used for all apparel and footwear sub-categories (expert judgement and Sandin, 2019). The transport steps for apparel and footwear products are detailed in Table 37.

Table 29 - Default packaging materials per piece of garment, for retail / in-store business scenario

| Sub-category | Packaging type | Raw material | Amount | Unit |
|---|---|---|---|---|
| Apparel | Primary | Polybag[42] | 0.020 | kg |
| | | Polybag[42] | 0.010 | kg |
| | | Paper bag | 0.022 | kg |
| | | Paper (hangtag) | 0.001 | kg |
| | | Plastic (hangtag) | 0.001 | kg |
| | Secondary | Corrugated cardboard | 0.060 | kg |
| | Tertiary | Wood pallets | 0.001* | kg |

[42] One polybag is for the film directly around the product and the other polybag is a proxy for the bag received in store

| Sub-category | Packaging type | Raw material | Amount | Unit |
|---|---|---|---|---|
| | | Shrink film | 0.001 | kg |
| Footwear | Primary | Polybag | 0.010 | kg |
| | | Paper bag | 0.022 | kg |
| | | Corrugated cardboard | 0.200 | kg |
| | | Paper (hangtag) | 0.001 | kg |
| | | Plastic (hangtag) | 0.001 | kg |
| | | Cellulose paper | 0.100 | kg |
| | Secondary | Corrugated cardboard | 0.060 | kg |
| | Tertiary | Wood pallets | 0.001* | kg |
| | | Shrink film | 0.001 | kg |

* Including default reuse factor (PEF method, 2021, 4.4.9.5 Average reuse rates for third party operated pools).

Table 30 - Default packaging materials per piece of garment, for e-commerce business scenario

| Sub-category | Packaging type | Raw material | Amount | Unit |
|---|---|---|---|---|
| Apparel | Primary | Corrugated cardboard | 0.060 | kg |
| | | Polybag | 0.020 | kg |
| | | Paper bag[43] | 0.022 | kg |
| | | Paper (hangtag) | 0.001 | kg |
| | | Plastic (hangtag) | 0.001 | kg |
| | Secondary | Corrugated cardboard | 0.060 | kg |
| | Tertiary | Wood pallets | 0.001* | kg |
| | | Shrink film | 0.001 | kg |
| Footwear | Primary | Corrugated cardboard | 0.200 | kg |
| | | Paper bag[43] | 0.022 | kg |
| | | Paper (hangtag) | 0.001 | kg |
| | | Plastic (hangtag) | 0.001 | kg |
| | | Cellulose paper | 0.100 | kg |
| | Secondary | Corrugated cardboard | 0.060 | kg |
| | Tertiary | Wood pallets | 0.001* | kg |
| | | Shrink film | 0.001 | kg |

[43] Refers to online outer bags

* Including default reuse factor (PEF method, 2021, 4.4.9.5 Average reuse rates for third party operated pools).

Table 31 - Default packaging materials per piece of garment, for F2C business scenario

| Sub-category | Packaging type | Raw material | Amount | Unit |
|---|---|---|---|---|
| Apparel | Primary | Polybag | 0.020 | kg |
| | | Paper (hangtag) | 0.001 | kg |
| | | Plastic (hangtag) | 0.001 | kg |
| | Secondary | Corrugated cardboard | 0.060 | kg |
| | Tertiary | Wood pallets | 0.001* | kg |
| | | Shrink film | 0.001 | kg |
| Footwear | Primary | Corrugated cardboard | 0.200 | kg |
| | | Paper (hangtag) | 0.001 | kg |
| | | Plastic (hangtag) | 0.001 | kg |
| | | Cellulose paper | 0.100 | kg |
| | Secondary | Corrugated cardboard | 0.060 | kg |
| | Tertiary | Wood pallets | 0.001* | kg |
| | | Shrink film | 0.001 | kg |

* Including default reuse factor (PEF method, 2021, 4.4.9.5 Average reuse rates for third party operated pools).

The default pallet mass value shall be used to account for the production impact of the pallets, but it shall be multiplied by the default reuse factor to obtain the total weight necessary to calculate the transport impact for one product as calculated in Table 31.

If packaging contains several apparel or footwear products (e.g. one corrugated cardboard box contains 30 t-shirts), the total packaging weight shall be divided by the number of products enclosed. The end of life of primary packaging shall be accounted for in LCS5, and the end of life of secondary and tertiary packaging shall be accounted for in LCS3. The default datasets proposed in the Annex VII already include the collection of the packaging at the end of life.

Packaging circularity is discussed in Section 6.1.5.5.

#### 6.1.5.5 Packaging circularity

If the packaging contains recycled materials or if it is sent to recycling or energy recovery at its end of life, the burdens and credits shall be allocated using the CFF,

presented in Section 5.10, using the default parameters available in the latest version of Part C of Annex II of the PEF method for the relevant packaging materials.
In the case of reusable packaging, the expected number of reuses of the packaging shall be used to allocate packaging production and end of life to the apparel or footwear product life cycle. Guidance on evaluating the number of reuses of the packaging is given in the PEF method in Section 4.4.9.3.

### 6.1.6 Transport of raw materials

| Note | Default raw materials and packaging transport processes can be found in ANNEX VII – Inventory modelling and default datasets ("Default datasets & DQR" tab). |
|---|---|

The transportation of raw materials used for apparel and footwear products from a supplier to the manufacturing plant shall be included in the raw materials life cycle stage (LCS 1). The transportation of raw materials requires the production of packaging (see Section 6.1.5) as well as its distribution. In case the raw material is bought as a global commodity[44], the transport shall be modelled as if the supplier is located outside the continent of the processing plant (ship). The impact of the transport shall be calculated per tonne kilometre (tkm), which is equivalent to the transport of 1 tonne (t) of product over 1 kilometre (km). The distance and transportation mode for each material coming to the manufacturing plant shall be based on specific data as indicated in Section 5.1.2, and weight-limited transport shall be considered for all materials transported. In the case of a data gap, the default values given in Table 32 shall be used (adapted from the PEF method 2021; Eurostat, 2015a, the shares of product mass transported for each origin from TS expertise). Note that in the case of multi-sourcing for the same item, the allocation of resources and emissions should be done by mass allocation.

For better clarity on how to use Table 32 for raw materials:

- As a default, a single transportation step shall be modelled for raw materials, representing all necessary transport legs.

[44] See **Definitions** Section

- As a proxy, that single transportation step is represented as the transport between the last pre-processing step and the first manufacturing step.
- The mass transported shall consider the mass of the raw materials at the entry gate of the first process step in LCS2, as explained in Section 6.1.2.
- The mass transported shall be multiplied by the distance (column 3) and the share of product mass transported (column 4) for the relevant transportation mode (column 6). Column 5 gives an example of the calculation.
- The parameters (distances, shares of product mass transported, and utilisation ratio) shall only be updated with primary specific data if the following data points are all available:
    - The origin of raw materials.
    - The distances for all transport legs. The distances shall be determined using the recommended calculators[45] & [46], or tools equally or more accurate.
    - The transport modes and the shares of product mass transported. The user of the PEFCR shall ensure that the sum of all the shares of product mass transported is equal to 100%. The utilisation ratio[47] shall be adapted in the EF database dataset if available, otherwise default data shall be used.
- The default datasets to use to model the transportation mode are available in ANNEX VII – Inventory modelling and default datasets ("Default datasets & DQR" tab).

Table 32 - Default transport scenarios for raw materials, semi-finished & intermediate products

| Supply chain location | Utilisation ratio | Distance (km) | Share of product mass transported (%) | Calculation (Mass (t) x distance (km) x Share of product mass transported (%)) | Transportation mode |
|---|---|---|---|---|---|
| Supplier located in the same continent as | 64% | 1'000 | 40% | Mass transported x 1'000 x 0.4 | Truck (>32 t, EURO 4) |
| | n/a | 1'000 | | Mass transported x 1'000 x 0.4 | Train (average freight train) |

[45] https://www.searates.com/services/distances-time/ or https://co2.myclimate.org/en/flight_calculators/new/
[46] https://co2.myclimate.org/en/flight_calculators/new/

[47] Real load transported divided by the mass of the payload considering empty returns (ratio of the distance travelled to collect the next load after unloading the product to the distance travelled to transport the product)

| Supply chain location | Utilisation ratio | Distance (km) | Share of product mass transported (%) | Calculation (**Mass (t) x distance (km) x Share of product mass transported (%)**) | Transportation mode |
|---|---|---|---|---|---|
| the processing plant | n/a | 800 | | Mass transported x 800 x 0.4 | Ship (barge) |
| Supplier located outside the continent of the processing plant (ship) | 64% | 1’000 | 55% | Mass transported x 1’000 x 0.55 | Truck (>32 t, EURO 4) |
| | n/a | 18’000 | | Mass transported x 18’000 x 0.55 | Ship (transoceanic container) |
| Supplier located outside the continent of the processing plant (plane) | 64% | 1’000 | 5% | Mass transported x 1’000 x 0.05 | Truck (>32 t, EURO 4) |
| | n/a | 10’000 | | Mass transported x 10’000 x 0.05 | Air freight (cargo plane) |

In case of multiple sources, a weighted average of the distances shall be calculated at product level if data are available, otherwise, at company level. For example, if 50% is coming from location 1 with a distance of 1’000 km and 50% from location 2 with a distance of 3’000 km, the weighted average distance is 50% x 1’000 km + 50% x 3’000 km = 2’000 km.

## 6.2 Manufacturing

If the user of the PEFCR is an SME without access to specific data, the country energy mix of the datasets can be updated using a global energy mix. Otherwise, primary data regarding the location of the manufacturing step, or, if available, data related to the specific energy mix of the supplier shall be used to model the energy inputs during the manufacturing stage. The electricity mix (i.e. national consumption) used shall be a production-weighted average when data from multiple sites are used.

Details on how to address multi-functionality of the manufacturing processes are provided in Section 5.7.

When the documentation of an EF dataset doesn't detail clearly if the dataset represents a single step or multiple step process, the user shall consider that it only applies to a single step. For example, for a cutting process dataset, the dataset shall be considered to represent one cutting operation.

The manufacturing waste shall be included in all modelling steps up to the output of the manufacturing stage. Manufacturing wastes shall be modelled in LCS2 according to the CFF (PEF method Section 4.4.2) and following the same end of life scenarios as the final products (apparels or footwear).

| Note | Default manufacturing processes can be found in ANNEX VII – Inventory modelling and default datasets (“Default datasets & DQR” tab). |
|---|---|

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

### 6.2.1 Amount of semi-finished & intermediate products

The amount of semi-finished & intermediate products needed to create one product shall take into account all the losses that occur throughout the product’s life cycle (pre-processing losses, manufacturing leftovers, manufacturing losses (including assembly losses), unsold consumer products and distribution losses).

This means that each manufacturing process must be disaggregated in single steps, including specific losses for each step. Only if a new, complete EF dataset of the aggregated manufacturing processes is created can a global loss rate be applied. More information on manufacturing losses is available in Section 6.2.1.1.

For each semi-finished & intermediate product, the relevant amount for input for the service process[48] shall be calculated using Equation 25.

$$SFIP_i = mBOM_i * (1 + ManuLeft) * \left( \prod_{j=1}^{NManuPro} (1 + ManuLoss_j) \right) * (1 + UnsoldProducts) * (1 + DistribLoss)$$

Equation 25

Where:

- ***SFIP$_i$***: is the total mass of the considered Semi-Finished & Intermediate Products (kg)
- ***mBOM$_i$***: is the mass of the considered SFIP in the BOM based on grading as defined in Section 3.3.1 (kg)
- ***ManuLeft***: is the fraction of the raw material lost through manufacturing leftovers (%).
- ***ManuLoss$_j$***: is the fraction of the raw material lost during manufacturing process j*,* and *NManuPro* is the number of manufacturing processes starting from the BOM based on grading up until the considered service process. If the material goes through one manufacturing process only, *NManuPro* = 1 and the equation considers only *ManuLoss1.* If *NManuPro* > 1, the product of (1+ *ManuLossj*) is made for each manufacturing process *j* to obtain the total losses for all *NManuPro* manufacturing processes (%). The losses for each specific manufacturing process as specified in the single datasets shall be considered.
- ***UnsoldProducts***: is the fraction of the raw material used to create unsold consumer products (see Section 6.3 for more details).
- ***DistribLoss***: is the fraction of the raw material lost through distribution losses (see Section 6.3 for more details)

[48] Service activities have inputs and outputs required to perform a service on another product, without the actual input and output of the product receiving the service. Services are therefore defined as immaterial exchanges, i.e., without a physical good changing ownership (https://support.ecoinvent.org/activities-products).

In case manual processes are used, the user of the PEFCR shall consider material losses.

Equation 25 shall be fully or partially applied depending on the mass that shall be calculated:

- Case 1: It shall be fully applied to calculate the input amount of semi-finished and intermediate product for the scaling of the service process.
- Case 2: It shall be applied up to the manufacturing step assessed ($ManuLoss_i$) to calculate how much input that manufacturing process requires.
- Case 3: It shall not consider the manufacturing losses to calculate the mass of semi-finished and intermediate products transported (Section 6.2.3).

For textile processes that require a conversion between $m^2$ and kg, the user of the PEFCR shall use either specific grammage of the fabric or use the default value of 200g/$m^2$.

To illustrate for a skirt with the following parameters:

- $mBOM_i$ weighs 150g;
- 10% manufacturing leftovers are created, $ManuLeft$ = 10%;
- The material goes through three LCS2 processes with the following losses $ManuLoss\ 1$ = 1%; $ManuLoss\ 2$ = 5%, $ManuLoss\ 3$ = 8%;
- 12% of products remain unsold to consumers $UnsoldProducts$ = 12%
- Losses during distribution are $DistribLoss$ = 1%.

Case 1 – The amount of input $SFIP_i$ for manufacturing process 1 is 0.15 * (1+0.10) * [(1+0.01)*(1+0.05)*(1+0.08)] * (1+0.12) * (1+0.01) = 0.214 kg. Same as case 3 of Section 6.1.2.

Case 2a – The mass of input $SFIP_i$ for manufacturing step 2 and output $SFIP_i$ for manufacturing process 1 is: 0.15 * (1+0.10) * [1+0.05)*(1+0.08)] * (1+0.12) * (1+0.01) = 0.212 kg

Case 2b – The mass of input $SFIP_i$ for manufacturing step 3 and output $SFIP_i$ for manufacturing step 2 is: 0.15 * (1+0.10) * [(1+0.08)] * (1+0.12) * (1+0.01) = 0.202 kg

Case 2c – The mass of output $SFIP_i$ for manufacturing step 3 is: 0.15 * (1+0.10) * (1+0.12) * (1+0.01) = 0.187 kg. Same as case 3 below.

Case 3 - The mass of $SFIP_i$ to use for the calculation of the $SFIP_i$ transport (Section 6.2.3) is: 0.15 * (1+0.10) * (1+0.12) * (1+0.01) = 0.187 kg.

#### 6.2.1.1 Manufacturing losses

Manufacturing losses are of two kinds:

- Processing losses
- Assembly losses and manufacturing leftovers

The calculation of the manufacturing losses of the semi-finished & intermediate products shall be performed according to Equation 22, Equation 23 and Equation 24 from Section 6.1.2.1.

If no company-specific information for a manufacturing process is available neither a default loss rate in the EF dataset used to model this step, a default loss rate of 15% shall be used (Quantis expertise). The end of life of these losses shall be considered in LCS2 according to the CFF (Section 5.10), unless company-specific data are used.

#### 6.2.1.2 Assembly losses and manufacturing leftovers

The mass of the assembly losses shall be determined as the difference between the mass of the BOM for one product and the mass of the product. This is a mandatory primary data point if the BOM is not available (Section5.1.3.1) The end of life of these losses shall be considered in LCS2 according to the CFF (Section 5.10).

In this life cycle stage, intermediary products that were not used, here defined as leftovers, are taken into account with an additional input of raw materials included in LCS1 and additional amounts manufactured, taken into account in LCS2. The end of life of leftovers shall take place in LCS2, and the default end of life scenarios correspond to the product's end of life scenarios (Section 6.5). A 5% rate of manufacturing leftovers shall be used (TS expertise judgement), unless primary data are used.

### 6.2.2 Manufacturing of the final product

Considerations for the manufacturing life cycle stage are different between apparel and footwear products and thus include different manufacturing processes, which are described separately below. In both cases, the supply chains have been broken into a system of “tiers” based on closeness to the apparel and footwear manufacturer (tier 1 being directly in contact with the manufacturer).

Apparel manufacturing (including apparel accessories) includes the following processes:

- Processing of raw materials, both from virgin and recycled content. This includes various processes such as pre-spinning processes (scouring, carding, combing, hackling, etc.), spinning fibres into yarn as well as processing non-fibrous products (for example leather, down or foam) into other intermediate products (for example padding).
- Manufacturing processes, such as knitting and weaving textiles, preparation, dyeing (fibre, yarn, fabric) and finishing of fabric.
- Component consolidation and final assembly of the product. This includes various processes such as cutting, assembly (cutting/sewing), garment wet processing/washing, dry treatment processes (e.g. laser), and the packaging for sale.

Footwear manufacturing includes the following processes:

- Component manufacturing including manufacturing of the individual parts of the shoe (bottom, mid and upper parts) as well as compound forming (sole production), in-sole production, die-cutting and sewing.
- Component consolidation and final assembly of the product. Processes included are: stockfitting, assembly and the packaging for sale.

Footwear manufacturing can be very complex and variable, with different manufacturing pathways found for the same type of shoe and brand. The processes above have been selected due to their applicability for most types of footwear products and manufacturing pathways, covering the most environmentally intensive processes.

In case the user of the PEFCR does not have access to the product-specific manufacturing information such as yarn size, yarn count or dyeing technology, manufacturing (including both pre-processing and manufacturing processes) shall be modelled using the same processes included in the RP-study and detailed in LCS2 of Table 10 as well as in Annex VII ("Default datasets & DQR" tab). These steps may not occur in the manufacturing chain of a single product but are a good representation of the average impact of manufacturing. Should the user of the PEFCR have access to partial product-specific manufacturing process information, relevant processes from the RP-study and detailed in LCS2 of Table 10 shall be selected, paying particular attention to the selection of a fair number of processes to neither overestimate nor underestimate the impact of the manufacturing stage, and covering the complete pre-processing and manufacturing stages.
In case the products valorise manufacturing leftovers of a previous apparel or footwear lifecycle, this shall be accounted according to the CFF (Section 5.10) and especially with CFF parameters reported in Table 21.

### 6.2.3 Transport of semi-finished and intermediate products

| Note | Default transport and packaging processes can be found in ANNEX VII – Inventory modelling and default datasets ("Default datasets & DQR" tab). |
|---|---|

The production of the packaging required for the transportation of semi-finished & intermediate products shall be accounted for in LCS1 (see Section 6.1.5), while its end of life shall be accounted for in LCS2. The packaging distribution (freight train, truck, ship or plane) is the same as the distribution of the raw materials (see Section 6.1.6), but it shall be accounted for in LCS2.

The distance and transportation mode for semi-finished and intermediate products between manufacturing plants shall be based on the specific data listed in Section 5.1.3.2, and weight-limited transport shall be considered for all materials transported. In the case of a data gap, the default values given in Table 32 shall be used (adapted from the PEF method 2021; Eurostat, 2015a).

For better clarity on how to use Table 32 for semi-finished and intermediate products:

- A single transportation step shall be modelled for semi-finished and intermediate products, representing all necessary transport steps.
- As a proxy, that single transportation step is represented as the transport between the last manufacturing step and assembly.
- The mass transported shall consider the mass of the semi-finished & intermediate products at the entry gate of the assembly step (see Section 6.2.1), as well as their packaging mass (see Section 6.1.5.4).
- The mass transported shall be multiplied by the distance (column 3) and the the share of product mass transported (column 4) for the relevant transportation mode (column 6). Column 5 gives an example of the calculation.
- The parameters (distances, shares of product mass transported , and utilisation ratio) shall only be updated with primary specific data if the following data points are all available:
    - The origin of all manufacturing steps
    - The distances shall be determined using the recommended calculators[49] & [50], or tools equally or more accurate.
    - The transport modes and the shares of product mass transported for each transport leg. The user of the PEFCR shall ensure that the sum of all the shares of product mass transported is equal to 100% for each transport leg. The utilisation ratio[51] shall be adapted in the EF database dataset if available, otherwise default data shall be used.
- The default datasets to use to model the transportation mode are available in ANNEX VII – Inventory modelling and default datasets ("Default datasets & DQR" tab).

## 6.3 Distribution stage

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

[49] https://www.searates.com/services/distances-time/ or https://co2.myclimate.org/en/flight_calculators/new/
[50] https://co2.myclimate.org/en/flight_calculators/new/

[51] Real load transported divided by the mass of the payload considering empty returns (ratio of the distance travelled to collect the next load after unloading the product to the distance travelled to transport the product)

the individual purchaser of the apparel or footwear product. In case supply-chain-specific information is available for one or several transport parameters, they may be applied following the Data Needs Matrix.

| Note | Default distribution processes can be found in ANNEX VII – Inventory modelling and default datasets ("Default datasets & DQR" tab). |
|---|---|

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

The waste of products during distribution and retail shall be included in the modelling.

The distribution life cycle stage is representative of a product sold on the European market (Section 3). It includes the impacts related to the transport of final apparel and footwear products to the final client, including the impacts related to intermediate storage and distribution losses. The final client is defined as a private individual. Considerations for the distribution stage are similar for all product categories because the transport modes and distances are not necessarily product specific.

### 6.3.1 Distribution models and transport legs

#### 6.3.1.1 Distribution models

Three distribution models are included in this PEFCR (Figure 10):

- The factory-to-consumer e-commerce scenario, referred to as 'F2C' below: [1a1] + [1a3] (see Figure 11);
- The 'classic' e-commerce scenario, using classic distribution pathways (warehouses and distribution centers), but no stores, referred to as 'classic e-commerce' below: [2a1] + [3a] + [3b1] + [3b3] (see Figure 12);
- The retail scenario, where consumers visit brick and mortar stores, referred to as 'retail' below: [2a2] + [4a] + [4b1] + [4b3] (see Figure 13).

The numbers in brackets refer to the transport legs described in Section 6.3.2 further below.

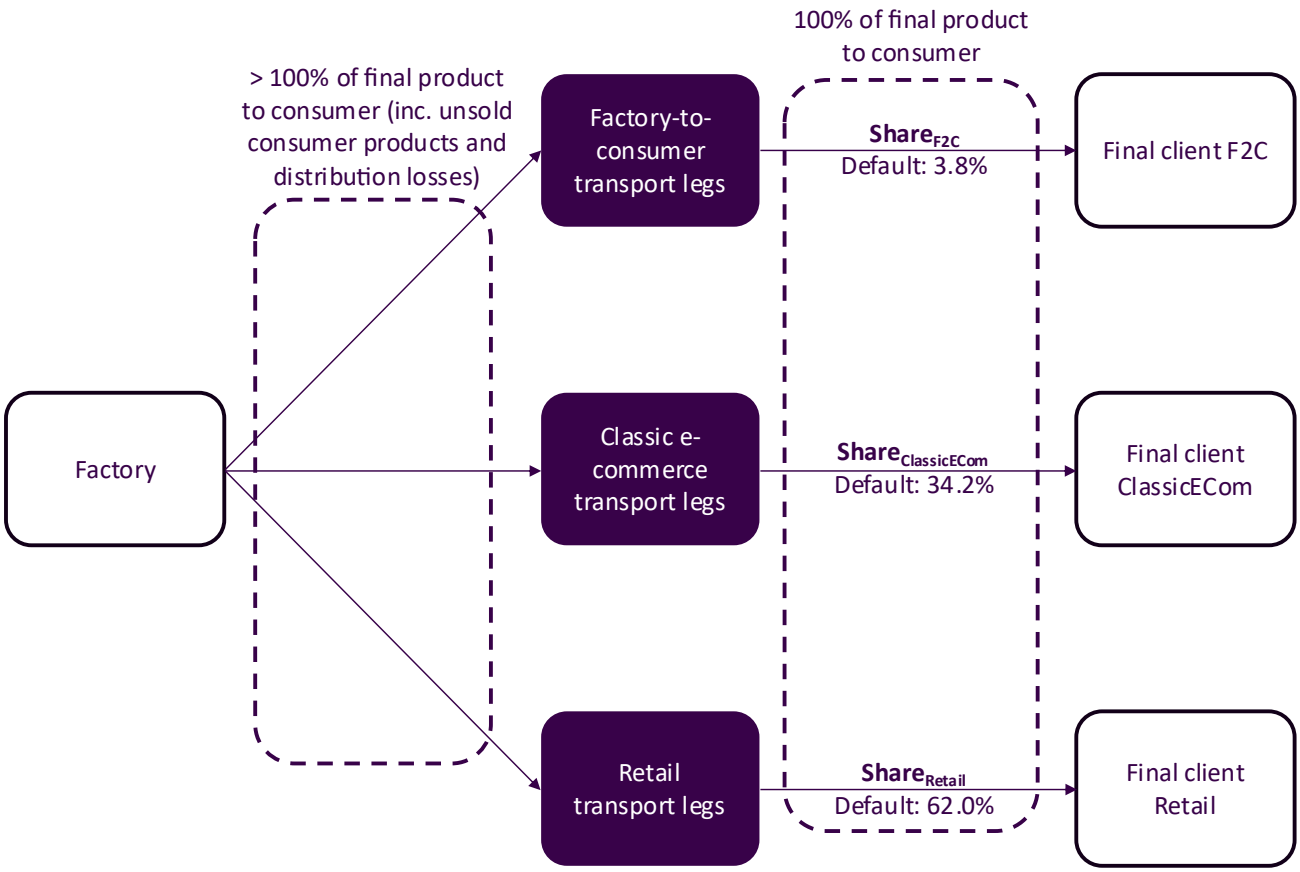



Figure 10 - Transport legs and scenarios for distribution (TS expertise).

The functional unit in Figure 10 refers to a final product sold to consumers, which is the sum of the shares of the different distribution scenarios (factory-to-consumer as per Figure 11, classic e-commerce as per Figure 12 and retail as per Figure 13). Due to unsold consumer products and distribution losses, more than 1 product will need to be manufactured to have 1 final product reach the consumer.

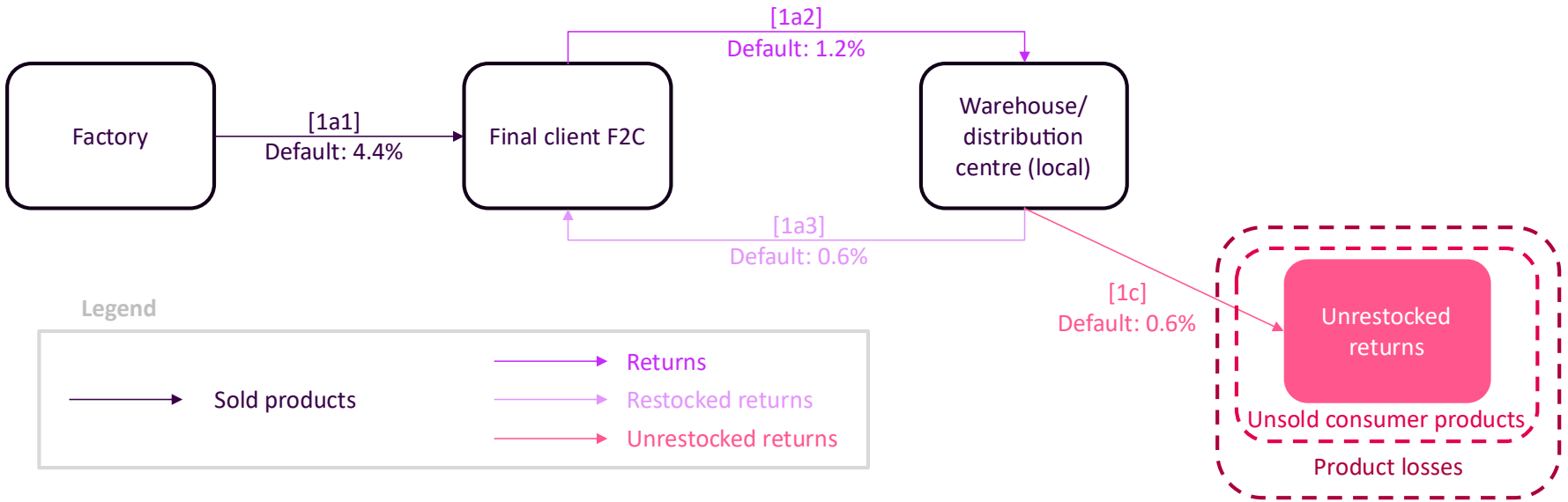
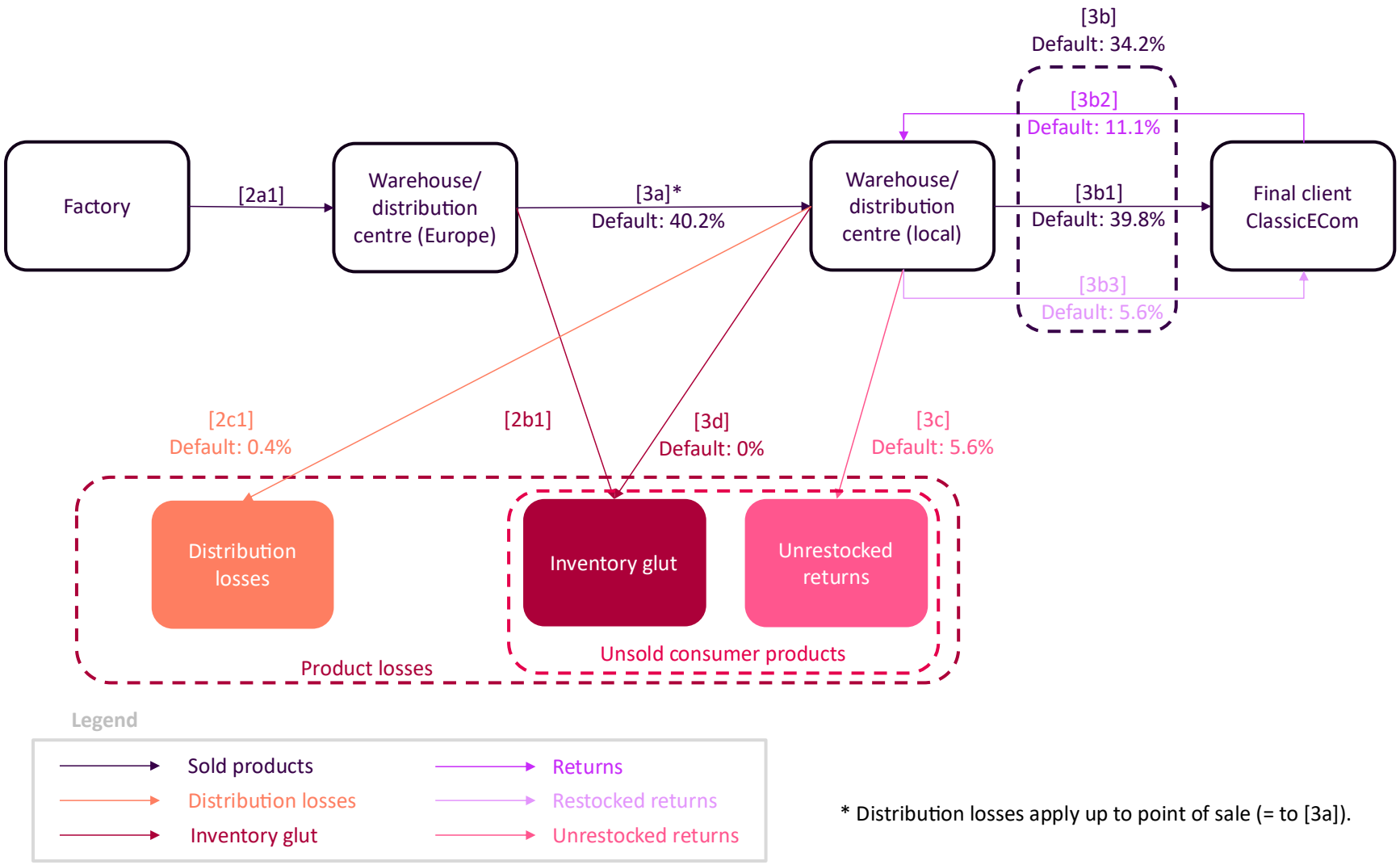



Figure 11 - Transport legs for the factory-to-consumer e-commmerce scenario.

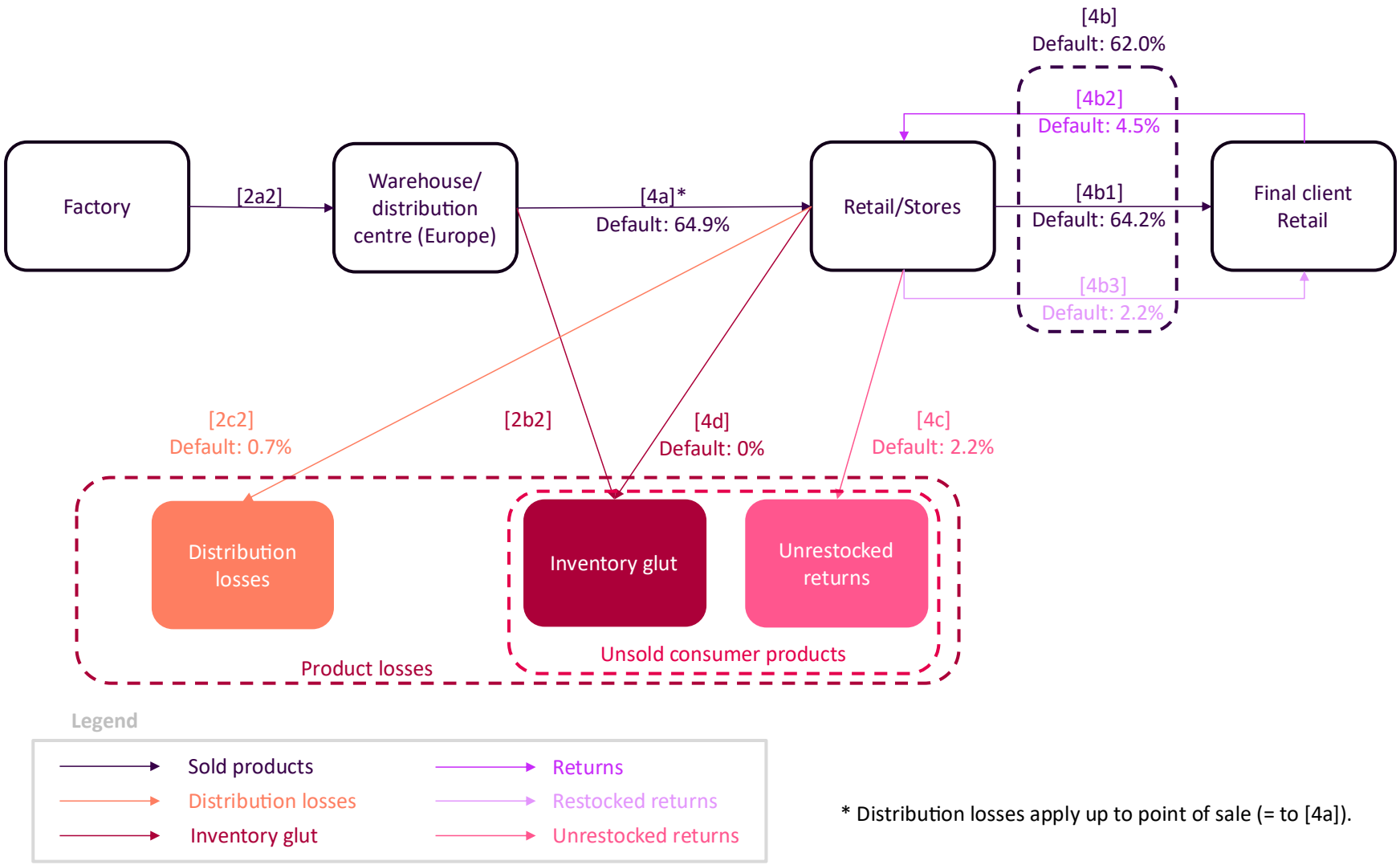
For F2C, factories are considered as the point of sale and therefore no distribution losses occur. Percentages may not add up due to rounding.




* Distribution losses apply up to point of sale (= to [3a]).

Figure 12 - Transport legs for the classic e-commerce scenario.

Percentages may not add up due to rounding.




* Distribution losses apply up to point of sale (= to [4a]).

Figure 13 - Transport legs for the retail scenario.

Percentages may not add up due to rounding.

The e-commerce scenario includes the transport of the final product from outside or inside Europe (factory) to a warehouse or distribution centre (located in Europe and/or local), the storage at the warehouse or distribution centre, and further transportation from the warehouse or distribution centre to the final client (see Figure 12);. F2C e-commerce is a growing part of online sales which involves a high share of international supply chains for products sold in Europe (see Figure 11). This includes both customised and non-customised products that are sent from the factory directly to the consumer. Customised products are defined as products that are specifically tailored to an individual's or organization's specifications and meets precise requirements for fit, style, and function and are not available off-the-shelf.

In the retail sales scenario, the product is first transported from the factory to a warehouse or distribution centre (located in Europe), then from the warehouse or distribution centre to a retail/ store, and finally transported to the final clients' home by the consumer (see Figure 13). To have 1 final product reach the consumer, more than 1 product will need to be manufactured due to manufacturing losses, unsold consumer products, and distribution losses. Company-specific data is required for the total share of unsold consumer products (UnsoldProducts, see Section 6.1.1), which include unrestocked returns (returned products that are not restocked for resale) and inventory glut (items that are made for a brand/retailer and sent to their distribution centre, such as surplus, excessive inventory, overstock and deadstock).

The distribution stage impacts depend mainly on supply chain specifics (e.g. local, intracontinental and international supply chains), corresponding transport modes and utilisation ratios, and distances covered, as well as product weights and volumes.

#### 6.3.1.2 Product returns and unsold consumer products

Returns are taken into account by multiplying the distances from warehouse to final client by the percentage of the returns. The distribution of unsold consumer products as defined in Section 6.1.1 shall be included in this life cycle stage (see Table 33 for default values and Table 34 for primary data calculation). Unsold consumer products in this life cycle stage takes the form of unrestocked items (e.g. items that were sold, brought back by the consumer and never restocked, see Section 6.1.1) and inventory

glut (Items that are made for a brand/retailer and sent to their distribution centre, such as surplus, excessive inventory, overstock and deadstock). It can be retained either at the point of sale (local warehouse or retail store, $InventoryGlut_{POS}$) or at the European distribution centre ($InventoryGlut_{DC}$). For example, a 16.3% unsold consumer products rate will mean that the weight of the final product transported will be multiplied by 1.163 per product for the transport steps up to where the unsold consumer products remain. The end of life of unsold consumer products shall take place in LCS3 and be modelled using the end-of-life scenarios described in Section 5.10, unless company-specific data are used.

Returns that are restocked and sold are considered part of the functional unit. Unrestocked returns fall under the unsold consumer products definition (see also Section 6.1.1).

#### 6.3.1.3 Distribution losses

A default loss rate DistribLoss of 1% (TS expertise) shall be used for the distribution stages until the point of sale for all apparel and footwear sub-categories, unless primary data are used.

Company-specific losses are modelled based on the total quantity of product that leaves the factory compared to the quantity that arrives in sellable condition at the point of sale.

The end of life of distribution losses shall take place in LCS3 and be modelled using the end-of-life scenarios described in Section 5.10, unless company-specific data are used.

### 6.3.2 Shares of transport legs

The final product will be distributed through the three distribution models with $Share_{Retail}$ the share of products sold through retail stores, $Share_{ClassicECom}$ the share of products sold through classic e-commerce and $Share_{F2C}$ the share of products sold through e-commerce directly delivered to the final client (F2C). The sum of the shares of the three distribution models shall add up to 100%, including returns that are sold again.

#### 6.3.2.1 Shares of transport legs for the F2C scenario

The following transport legs (adapted from the PEF method) are considered for apparel and footwear, with the number in brackets matching Figure 11 above:

- From factory to the final client (F2C) [1a1];
- From final client to local warehouse/ DC for F2C returns [1a2];
- From local warehouse/ DC to final client for restocked F2C returns [1a3];

It is assumed that the non-restocked share of consumer returns to point of sale ([1c]), is directly sent to end-of-life. This transport shall be modelled according to Section 5.10.

$\mathbf{Share_{F2C}}$ ([1a]) is the sum of the share of products sold to consumers through factory-to-consumer, minus the share of F2C products returned at a return rate of $ReturnRate_{ClassicECom}$ ([1a2]), plus the share of returned products restocked at a rate of RestockRate and sold again through classic e-commerce ([1a3]). The F2C shall only be considered for non-customised products, and customised F2C products shall consider a return rate of 0%.

#### 6.3.2.2 Shares of transport legs for the classic e-commerce scenario

The following transport legs (adapted from the PEF method) are considered for apparel and footwear, with the number in brackets matching Figure 12 above:

- From factory to warehouse/ distribution centre (DC) located in Europe [2a1];
- From a warehouse/ distribution centre located in Europe to a local warehouse/ distribution centre [3a];
- From local warehouse/ distribution centre to final client [3b1] and [3b3];
- From final client to local warehouse/ distribution centre for returns [3b2];

It is assumed that the non-restocked share of consumer returns to point of sale ([3c]), the inventory glut ([2b1] and [3d]) and the distribution losses ([2c1]) are directly sent to end-of-life. This transport shall be modelled according to Section 5.10.

**Share$_{ClassicECom}$** ([3b]) is the sum of the share of products sold to consumers through classic e-commerce ([3b1]), minus the share of classic e-commerce products returned at a return rate of ReturnRate$_{ClassicECom}$ ([3b2]), plus the share of returned products restocked at a rate of RestockRate and sold again through classic e-commerce ([3b3]).

#### 6.3.2.3 Shares of transport legs for the retail scenario

The following transport legs (adapted from the PEF method) are considered for apparel and footwear, with the number in brackets matching Figure 13 above:

- From factory to warehouse/ distribution centre (DC) located in Europe [2a2];
- From warehouse/ distribution centre located in Europe to retail/ stores [4a];
- From retail/ stores to the final client (consumer travel) [4b1] and [4b3]; and
- From the final client to the retail/ stores for returns (consumer travel) [4b2].

It is assumed that the non-restocked share of consumer returns to point of sale ([4c]), the inventory glut ([2b2] and [4d]) and the distribution losses ([2c2]) are directly sent to end-of-life. This transport shall be modelled according to Section 5.10.

**Share$_{Retail}$** ([4b]) is the sum of the share of products sold to consumers through retail ([4b1]), minus the share of retail products returned at a return rate of ReturnRate$_{Retail}$ ([4b2]), plus the share of returned products restocked at a rate of RestockRate and sold again through retail ([4b3]).

#### 6.3.2.4 Default shares of transport legs

To have 1 final product reach the consumer, more than 1 product will need to be manufactured due to losses, considering unrestocked returns, inventory glut and distribution losses. UnrestockedReturns represents the share of unrestocked returns ([1c] for factory-to-consumer, [3c] for classic e-commerce and [4c] for retail). InventoryGlut represents the share of inventory glut ([2b1] for InventoryGlut$_{DC}$ + [3d] for InventoryGlut$_{POS}$ for the classic e-commerce scenario and [2b2] for InventoryGlut$_{DC}$ + [4d] for InventoryGlut$_{POS}$ for the retail scenario).

The share of unsold consumer products is company-specific data and it is used to calculate inventory glut. Due to the lack of data (Cascale, 2022) on the split of inventory glut between these locations ([2b1] vs [3d] and [2b2] vs [4d]), the user of the

PEFCR shall assume that inventory glut only occurs at the European distribution centre (meaning that $InventoryGlut_{POS}$ = 0 and therefore [3d] = [4d] = 0), unless primary data for $InventoryGlut_{POS}$ and $InventoryGlut_{DC}$ are used.

The default shares of transport legs in Table 33 shall be used (Cascale 2022), unless primary data are used. These values were obtained using default data (Cascale 2022) and the formulas in Table 34, which contains the detailed calculations.

Table 33 - Default shares of product per transport leg

| Transport leg | Default share of manufactured product transported per transport leg, including distribution losses (%) |
|---|---|
| [1] | 3.8% |
| [1a1] | 4.4% |
| [1a2] | 1.2% |
| [1a3] | 0.6% |
| [1c] | 0.6% |
| [2a1] | $[3a] * \left(1 + \frac{InventoryGlut_{DC}}{1 - InventoryGlut_{DC}}\right)$ |
| [2a2] | $[4a] * \left(1 + \frac{InventoryGlut_{DC}}{1 - InventoryGlut_{DC}}\right)$ |
| [2b1] | $[3a] * \frac{InventoryGlut_{DC}}{1 - InventoryGlut_{DC}}$ |
| [2b2] | $[4a] * \frac{InventoryGlut_{DC}}{1 - InventoryGlut_{DC}}$ |
| [2c1] | 0.4% |
| [2c2] | 0.7% |
| [3a] | 40.2% |
| [3b] | 34.2% |
| [3b1] | 39.8% |
| [3b2] | 11.1% |
| [3b3] | 5.6% |
| [3c] | 5.6% |
| [4a] | 64.9% |
| [4b] | 62.0% |
| [4b1] | 64.2% |
| [4b2] | 4.5% |
| [4b3] | 2.2% |
| [4c] | 2.2% |
| [3d] | 0% |
| [4d] | 0% |

#### 6.3.2.5 Calculation of shares of transport legs using primary data

To have 1 final product reach the consumer, more than 1 product will need to be manufactured due to losses, considering unrestocked returns, inventory glut and distribution losses. UnrestockedReturns represents the share of unrestocked returns ([1c] for factory-to-consumer, [3c] for classic e-commerce and [4c] for retail).

InventoryGlut represents the share of inventory glut ([2b1] for $InventoryGlut_{DC}$ + [3d] for $InventoryGlut_{POS}$ for the classic e-commerce scenario and [2b2] for $InventoryGlut_{DC}$ + [4d] for $InventoryGlut_{POS}$ for the retail scenario).

If only primary data for shares of distribution models $Share_{F2C}$, $Share_{ClassicECom}$ and $Share_{Retail}$ are used, the user of the PEFCR shall adapt the default values in Table 33 using Equation 26.

$$Share_{CSDM}[X] = Share[X] * \frac{Share_{CS-DM}}{Share_{CS-F2C} + Share_{CS-ClassicECom} + Share_{CS-Retail}}$$

Equation 26

With the following parameters:

**$Share_{CSDM}$[X] (%):** Company-specific share of product mass transported per transport leg X for distribution model DM.

**Share[X] (%):** Default share of product mass transported per transport leg X. See Table 33 for default values.

**$Share_{CS-DM}$ (%):** Company-specific share of distribution model DM (this is either $Share_{CS-F2C}$, $Share_{CS-ClassicECom}$ or , $Share_{CS-Retail}$ depending on which transport leg is being calculated)

**$Share_{CS-F2C}$ (%):** Company-specific share of F2C distribution model

**$Share_{CS-ClassicECom}$ (%):** Company-specific share of classic e-commerce distribution model

**$Share_{CS-Retail}$ (%):** Company-specific share of retail distribution model

The shares of a product relative to each transport leg are calculated using primary data according to Table 34.The default value of 50% shall be used for RestockRate (i.e. one out of every two returns are resold), the default value of 7% shall be used for $ReturnRate_{Retail,}$ and the default value of 28% shall be used for $ReturnRate_{ClassicECom}$ (Cascale, 2022), unless primary data are used.

The share of unsold consumer products is company-specific data and it is used to calculate inventory glut. Due to the lack of data (Cascale, 2022) on the split of

inventory glut between these locations ([2b1] vs [3d] and [2b2] vs [4d]), the user of the PEFCR shall assume that inventory glut only occurs at the European distribution centre (meaning that $InventoryGlut_{POS}$ = 0 and therefore [3d] = [4d] = 0), unless primary data for $InventoryGlut_{POS}$ and $InventoryGlut_{DC}$ are used.

The calculation for total unsold consumer products is shown in Equation 27:

$$\begin{aligned} UnsoldProducts &= InventoryGlut_{DC} + UnrestockedReturns + InventoryGlut_{POS} \\ &= [2b1] + [2b2] + [1c] + [3c] + [4c] + [3d] + [4d] \\ &\xrightarrow{with\ default\ values} ([3a] + [4a]) * \frac{InventoryGlut_{DC}}{1 - InventoryGlut_{DC}} + [1c] + [3c] + [4c] \\ &= (39.8\% + 64.2\%) * \frac{InventoryGlut_{DC}}{1 - InventoryGlut_{DC}} + 0.6\% + 5.6\% + 2.2\% \\ &= 104.0\% * \frac{InventoryGlut_{DC}}{1 - InventoryGlut_{DC}} + 8.4\% \end{aligned}$$

Equation 27

Default values as shown in Equation 28 shall be used, unless primary data for return rates, restock rate, inventory glut at DC and inventory glut at POS are used.

$$InventoryGlut_{DC} = \frac{Y}{Y+1}, \qquad where\ Y = \frac{(UnsoldProducts - 8.4\%)}{104.0\%}$$

Equation 28

If UnsoldProducts is less than 8.4%, InventoryGlutDC shall have a default value of 0 and the default values of $ReturnRate_{ClassicECom}$, $ReturnRate_{Retail}$ and RestockRate shall be used.

Table 34 - Share of product per transport leg for primary data

| Transport leg | Share of manufactured product transported per transport leg (%) |
|---|---|
| [1] | $= [1a1] - [1a2] + [1a3] = [1a1] * (1 - ReturnRate_{ClassicECom} * (1 - RestockRate)) = \text{Share}_{CS-F2C}$ |
| [1a1] | $= \frac{[1]}{1 - ReturnRate_{ClassicECom} * (1 - RestockRate)} = \frac{Share_{CS-F2C}}{1 - ReturnRate_{ClassicECom} * (1 - RestockRate)}$ |
| [1a2] | $= [1a1] * ReturnRate_{ClassicECom} = \frac{Share_{F2C} * ReturnRate_{ClassicECom}}{1 - ReturnRate_{ClassicECom} * (1 - RestockRate)}$ |
| [1a3] | $= [1a2] * RestockRate$ |
| [1c] | $= [1a2] * (1 - RestockRate)$ |
| [2a1] | $= [3a] + [2b1]$ |
| [2a2] | $= [4a] + [2b2]$ |

| Transport leg | Share of manufactured product transported per transport leg (%) |
|---|---|
| [2b1] | $= [3a] * \frac{InventoryGlut_{DC}}{1 - InventoryGlut_{DC}}$ |
| [2b2] | $= [4a] * \frac{InventoryGlut_{DC}}{1 - InventoryGlut_{DC}}$ |
| [2c1] | $= [3a] * DistribLoss$ |
| [2c2] | $= [4a] * DistribLoss$ |
| [3a] | $= [3b] + [3c] + [3d] + [2c1]$ $= \frac{Share_{CS-ClassicECom}}{1 - ReturnRate_{ClassicECom} * (1 - RestockRate)} * \frac{1}{1 - InventoryGlut_{POS}} * (1 + DistribLoss)$ |
| [3b] | $= Share_{CS-ClassicECom} = [3b1] - [3b2] + [3b3]$ $= [3b1] * \left(1 - ReturnRate_{ClassicECom} * (1 - RestockRate)\right)$ |
| [3b1] | $= [3a] - [3d] = \frac{Share_{CS-ClassicECom}}{1 - ReturnRate_{ClassicECom} * (1 - RestockRate)}$ |
| [3b2] | $= [3b1] * ReturnRate_{ClassicECom}$ $= \frac{Share_{CS-ClassicECom} * ReturnRate_{ClassicECom}}{1 - ReturnRate_{ClassicECom} * (1 - RestockRate)}$ |
| [3b3] | $= [3b2] * RestockRate$ |
| [3c] | $= [3b2] * (1 - RestockRate)$ |
| [4a] | $= [4b] + [4c] + [4d] + [2c2]$ $= \frac{Share_{CS-Retail}}{1 - ReturnRate_{Retail} * (1 - RestockRate)} * \frac{1}{1 - InventoryGlut_{POS}} * (1 + DistribLoss)$ |
| [4b] | $= Share_{Retail} = [4b1] - [4b2] + [4b3]$ $= [4a] * (1 - ReturnRate_{Retail} * (1 - RestockRate))$ |
| [4b1] | $= [4a] - [4d] = \frac{Share_{CS-Retail}}{1 - ReturnRate_{Retail} * (1 - RestockRate)}$ |
| [4b2] | $= [4b1] * ReturnRate_{Retail}$ $= \frac{Share_{Retail} * ReturnRate_{Retail}}{1 - ReturnRate_{Retail} * (1 - RestockRate)}$ |
| [4b3] | $= [4b2] * RestockRate$ |
| [4c] | $= [4b2] * (1 - RestockRate)$ |
| [3d] | $= [3a] * InventoryGlut_{POS}$ $= \frac{Share_{CS-ClassicECom}}{1 - ReturnRate_{ClassicECom} * (1 - RestockRate)} * \frac{InventoryGlut_{POS}}{1 - InventoryGlut_{POS}}$ |
| [4d] | $= [4a] * InventoryGlut_{POS} =$ $\frac{Share_{CS-Retail}}{1 - ReturnRate_{Retail} * (1 - RestockRate)} * \frac{InventoryGlut_{POS}}{1 - InventoryGlut_{POS}}$ |

### 6.3.3 Distribution impacts

The distribution impacts are based on:

a) the mass or the volume of the product being transported including primary, secondary and tertiary packaging, considering the distribution losses and the unsold consumer products mass.

b) the distance travelled and the mode of transport.

The transport of unsold consumer products for disposal includes inventory glut ([2b1], [2b2], [3d] and [4d]) and unrestocked returns ([1c], [3c] and [4c]). The transport of distribution losses for disposal includes [2c1] and [2c2]. The end-of-life transport of these product losses shall be modelled according to Section 5.10 and shall be accounted for in LCS3.

#### 6.3.3.1 Mass and volume transported

The weight transported is defined as the sum of the product weight (**$Weight_{Product}$**) plus the weight of all removable accessories such as hangtags (price label, brand tags, etc.), primary (**$Weight_{Pack1}$**), secondary (**$Weight_{Pack2}$**) and tertiary (**$Weight_{Pack3}$**) packaging, considering the distribution losses and unsold consumer products.

The product volume transported is defined as the volume of the product including primary packaging (**$Volume_{Product}$**), and the default values in Table 35 shall be used unless primary data are used (primary data provided by ADEME, Nov. 2020). To account for the additional volume of secondary and tertiary packaging in the relevant transport legs, the product volume is multiplied by a volume factor (**$Volume_{Factor}$**) and a default volume factor of 4 (OEFSRs retail, 2018) shall be used unless primary data of packaging volume is used.

Table 35 - Default representative product volumes

| No. | Sub-category | Default product volume ($m^3$) |
|---|---|---|
| 1 | T-shirts | 0.0018 |
| 2 | Shirts and blouses | 0.006 |
| 3 | Sweaters and midlayers | 0.0102 |
| 4 | Jackets and coats | 0.015 |
| 5 | Pants and shorts | 0.004 |
| 6 | Dresses, skirts and jumpsuits | 0.007 |
| 7 | Leggings, stockings, tights and socks | 0.0006 |
| 8 | Underwear | 0.0006 |
| 9 | Swimwear | 0.0006 |
| 10 | Apparel accessories | 0.0012 |
| 11 | Open-toed shoes | 0.0048 |
| 12 | Closed-toed shoes | 0.018 |
| 13 | Boots | 0.024 |

The weights and volumes relative to each transport leg are given in Table 36. When both weights and volumes are indicated, the formula **in bold** indicates the one relevant for the calculation, depending on if the transport is weight-limited (e.g. transport in

trucks or ships) or volume-limited (e.g. passenger car or van). For packaging, the default values in Table 29 (for the retail scenario), Table 30 (for the classic e-commerce scenario), and Table 31 (for the F2C scenario) shall be used unless primary data are used. The transport of unsold consumer products (inventory glut and unrestocked returns) and distribution losses disposal transport marked with (*) is approximated by weight-limited product disposal transport (see Section 5.10).

Table 36 - Weights and volumes transported per transport leg

| Transport leg | Packaging included | Weight transported (kg/product) Weight[X] | Volume transported to/by final client ($m^3$/product) Volume[X] |
|---|---|---|---|
| [1a1] | Primary + Secondary + Tertiary | $Weight_{Product} + Weight_{Pack1} + Weight_{Pack2} + Weight_{Pack3}$ | N/A (weight-limited transport) |
| [1a2] | Primary + Secondary | N/A (volume-limited transport) | $Volume_{Product}$ |
| [1a3] | Primary + Secondary | N/A (volume-limited transport) | $Volume_{Product}$ |
| [1c]* | N/A | $Weight_{Product}$ | N/A (weight-limited transport) |
| [2a1] [2a2] | Primary + Secondary + Tertiary | $Weight_{Product} + Weight_{Pack1} + Weight_{Pack2} + Weight_{Pack3}$ | N/A (weight-limited transport) |
| [2b1]* [2b2]* | N/A | $Weight_{Product}$ | N/A (weight-limited transport) |
| [2c1]* [2c2]* | N/A | $Weight_{Product}$ | N/A (weight-limited transport) |
| [3a] | Primary + Secondary + Tertiary | $Weight_{Product} + Weight_{Pack1} + Weight_{Pack2} + Weight_{Pack3}$ | N/A (weight-limited transport) |
| [3b1] [3b3] | Primary + Secondary | N/A (volume-limited transport) | $Volume_{Product}$ |
| [3b2] | Primary + Secondary | N/A (volume-limited transport) | $Volume_{Product}$ |
| [3c]* | N/A | $Weight_{Product}$ | N/A (weight-limited transport) |
| [3d]* | N/A | $Weight_{Product}$ | N/A (weight-limited transport) |
| [4a] | Primary + Secondary + Tertiary | $Weight_{Product} + Weight_{Pack1} + Weight_{Pack2} + Weight_{Pack3}$ | N/A (weight-limited transport) |

| Transport leg | Packaging included | Weight transported (kg/product) Weight[X] | Volume transported to/by final client ($m^3$/product) Volume[X] |
|---|---|---|---|
| [4b1] [4b3] | Primary | N/A (volume-limited transport) | $Volume_{Product}$ |
| [4b2] | Primary | N/A (volume-limited transport) | $Volume_{Product}$ |
| [4c]* | N/A | $Weight_{Product}$ | N/A (weight-limited transport) |
| [4d]* | N/A | $Weight_{Product}$ | N/A (weight-limited transport) |

#### 6.3.3.2 Distance travelled

Company-specific data, i.e. the distance and the share of product mass transported, is mandatory for cargo plane transport in transport steps [1a1], [2a1], [2a2], and [3a]. It shall be determined at company level, using data from the most recent annual administration period.

The transport parameters (distances, shares of product mass transported, and utilisation ratio) shall be updated with primary specific data if data are available:

- The utilisation ratio[52] shall be adapted in the EF database dataset.
- The distances shall be determined using the recommended calculators[53 & 54], or tools equally or more accurate.
- The user of the PEFCR shall ensure that the sum of all the shares of product mass transported is equal to 100% for each transport leg.

The default datasets to use to model the transportation mode are available in ANNEX VII – Inventory modelling and default datasets ("Default datasets & DQR" tab). For suppliers outside of Europe, ROW w/o EU+EFTA datasets shall be used. For truck transport, if a EURO 4 ROW w/o EU+EFTA dataset is not available, a EU+EFTA+UK (>32t, EURO 4) dataset should be used as an acceptable proxy.

In case of multiple sources, a weighted average of the distances shall be calculated at product level if data are available, otherwise, at company level. For example, if 50% is coming from location 1 with a distance of 1'000 km and 50% from location 2 with a

[52] Real load transported divided by the mass of the payload considering empty returns (ratio of the distance travelled to collect the next load after unloading the product to the distance travelled to transport the product)
[53] https://www.searates.com/services/distances-time/ or https://co2.myclimate.org/en/flight_calculators/new/
[54] https://co2.myclimate.org/en/flight_calculators/new/

distance of 3’000 km, the weighted average distance is 50% x 1’000 km + 50% x 3’000 km = 2’000 km.

The default values for the transport processes from retail/ stores to the final client in Table 37 are given as roundtrip distances and datasets for consumer travel are per kilometre.

Table 37 - Default transport parameters per product

| No. | Transport leg [X] | Default per functional unit | | | | |
|---|---|---|---|---|---|---|
| | | Supply chain location [Z] | Distance (km) | Utilisation ratio | Share of product mass transported for each origin (%) | Transport mode [Y] |
| 1a1 | Factory to final client (factory-to-consumer) | Local | 1'200 | 64% | 25% * (100 – $SharePlane_{F2C}$) | Truck (>32t, EURO 4) |
| | | Intracontinental | 3'500 | 64% | 75%* (100 – $SharePlane_{F2C}$) | Truck (>32t, EURO 4) |
| | | International (ship) | 1'000 | 64% | 0% | Truck (>32t, EURO 4) |
| | | | 18'000 | n/a | | Ship (transoceanic container) |
| | | International (plane) | 1'000 | 64% | $SharePlane_{F2C}^{+}$ | Truck (>32t, EURO 4) |
| | | | $Distance_{F2C}^{+}$ | n/a | | Cargo plane |
| 1a2 | From final client to local warehouse/ DC (returns) | Local | 250 (round trip) | 50%$^{++}$ | 100% | Van (lorry <1.2t, EURO 3) |
| 1a3 | From local warehouse/ DC to final client | Local | 250 (round trip) | 50%$^{++}$ | 100% | Van (lorry <1.2t, EURO 3) |
| 2a1 2a2 | Factory to warehouse/ DC located in Europe | Local | 1'200 | 64% | 5.6% * (100 - $SharePlane_{WarehouseEU}$) | Truck (>32t, EURO 4) |
| | | Intracontinental (barge) | 2'500 | 64% | 3.3% * (100 - $SharePlane_{WarehouseEU}$) | Truck (>32t, EURO 4) |
| | | | 800 | n/a | | Ship (barge) |
| | | Intracontinental (train) | 800 | 64% | 15.6% * (100 - $SharePlane_{WarehouseEU}$) | Truck (>32t, EURO 4) |
| | | | 2'500 | n/a | | Train (average freight train) |
| | | International (ship) | 1'000 | 64% | 73.3% * (100 - $SharePlane_{WarehouseEU}$) | Truck (>32t, EURO 4) |
| | | | 18'000 | n/a | | Ship (transoceanic container) |
| | | International (plane) | 1'000 | 64% | $SharePlane_{WarehouseEU}^{+}$ | Truck (>32t, EURO 4) |
| | | | $Distance_{WarehouseEU}^{+}$ | n/a | | Cargo plane |
| | | International (train) | 1'000 | 64% | 2.2% * (100 - $SharePlane_{WarehouseEU}$) | Truck (>32t, EURO 4) |
| | | | 10'000 | n/a | | Train (average freight train) |
| 3a | From warehouse/ DC located in Europe to local warehouse/ DC | Intracontinental (plane) | 500 | 64% | $SharePlane_{WarehouseLocal}^{+}$ | Truck (>32t, EURO 4) |
| | | | $Distance_{WarehouseLocal}^{+}$ | n/a | | Cargo plane |
| | | Intracontinental (train) | 1000 | 64% | 74% * (100 - $SharePlane_{WarehouseLocal}^{+}$) | Truck (>32t, EURO 4) |

| No. | Transport leg [X] | Default per functional unit | | | | |
|---|---|---|---|---|---|---|
| | | Supply chain location [Z] | Distance (km) | Utilisation ratio | Share of product mass transported for each origin (%) | Transport mode [Y] |
| | | | 3000 | n/a | 74% * (100 - $SharePlane_{WarehouseLocal}^{+}$) | Train (average freight train) |
| | | Intracontinental (truck) | 4000 | 64% | 26% * (100 - $SharePlane_{WarehouseLocal}^{+}$) | Truck (>32t, EURO 4) |
| 3b1 3b3 | From local warehouse/ DC to final client | Local | 250 (round trip) | 50%$^{++}$ | 100% | Van (lorry <1.2t, EURO 3) |
| 3b2 | From final client to local warehouse/ DC (returns) | Local | 250 (round trip) | 50%$^{++}$ | 100% | Van (lorry <1.2t, EURO 3) |
| 4a | From warehouse/ DC located in Europe to retail/ stores | Local | 1'200 | 64% | 100% | Truck (>32t, EURO 4) |
| 4b1 4b3 | From retail/ stores to final client (consumer travel) | Local | 5 | See below | 62% | Passenger car (average) |
| | | | 5 | 50%$^{++}$ | 5% | Van (lorry <1.2t, EURO 3) |
| | | | N/A | N/A | 33% | No impact modelled (walking, cycling etc) |
| 4b2 | Final client to retail/ stores (customer travel, returns) | Local | 5 | See below | 62% | Passenger car (average) |
| | | | 5 | 50%$^{++}$ | 5% | Van (lorry <1.2t, EURO 3) |
| | | | N/A | N/A | 33% | No impact modelled (walking, cycling etc) |

$^{+}$ Company-specific data estimated at company level from the most recent annual administration period

$^{++}$ In case there is no dataset for (lorry <1.2t, EURO 3) available, a van (lorry <7.5t, EURO 3) with a 20% utilisation ratio shall be used

**Consumer travel**

The impacts from consumer travel (allocation of the car impact) shall be based on volume with a single distance of 5 km (or 5000 m, total distance of transport, PEF Method, 4.4.3.5 Default scenarios – from factory to final client). For an average car, the maximum volume that can be transported is 0.2 $m^3$, which equals 1/3 of a 0.6 $m^3$ trunk, whereas for products bigger than 0.2 $m^3$, the full car transport impact shall be included. Considering products that are sold through in-store retail, the volume of the product (including primary packaging) shall be used to allocate the transport burdens, and the allocation factor shall be calculated as the volume of the product divided by the maximum volume of 0.2 $m^3$.

The default value for the volume is specified in Table 35.

#### 6.3.3.3 Calculation of distribution impacts

For weight-limited transport as prescribed by Table 36, the activity quantity (in kgkm) for the distribution impact calculation per transport mode Y is calculated using Equation 29:

$$\mathrm{ActivityW}_{XY} = \mathrm{Share}_{[X]} * \mathrm{Weight}_{[X]} * \mathrm{Distance}_{[XY]} * \mathrm{ShareProductMass}_{[XYZ]}$$

Equation 29

With the following parameters:

**Share[X] (%):** Share of product mass transported per transport leg X. See Table 33 for default values and Table 34 for detailed calculation using primary data.

**Weight[X] (kg/product):** Weight transported per transport leg X. See Table 36 for detailed calculation.

**Distance[XY] (km):** Transport distance per transport leg X and transport mode Y. See Table 37 for default values.

**ShareProductMass[XYZ] (%):** Share of product mass transported for each transport leg X, transport mode Y and origin Z. See Table 37 for default values.

For volume-limited transport as prescribed by Table 36, the activity quantity (in kilometers) for the distribution impact calculation per transport mode Y is calculated using Equation 30:

$$\text{ActivityV}_{XY} = \text{Share}_{[X]} * \frac{\text{Volume}_{[X]}}{\text{VolumeMax}_{[Y]}} * \text{Distance}_{[XY]} * \text{ShareProductMass}_{[XYZ]}$$

Equation 30

With the following parameters:

**Share[X] (%):** Share of product mass transported per transport leg X. See Table 33 for default values and Table 34 for detailed calculation using primary data.

**VolumeMax[Y]** ($m^3$): Maximum volume transported by transport mode Y. For passenger cars, this is 0.2 $m^3$ (PEF Method, 2021).

**Volume[X] ($m^3$/product):** Volume transported per transport leg X. See Table 36 for detailed calculation and Table 35 for default values.

**Distance[XY] (m):** Transport distance per transport leg X and transport mode Y. see Table 37 for default values.

**ShareProductMass[XYZ] (%):** Share of product mass transported for each transport leg X, transport mode Y and origin Z. See Table 37 for default values.

### 6.3.4 Storage at warehouse/ DC and retail/ store

Storage shall be modelled for the scenarios including warehouse/distribution centres and retail/ stores as defined in Figure 11 for the F2C scenario, Figure 12 for the classic e-commerce scenario and Figure 13 for the retail scenario. For the F2C e-commerce scenario, this is only applicable for the returned products. The storage characteristics (capacity, time, etc.) required for each transport leg can be found in Table 38.

The impacts generated by the storage of final products in warehouses or retail locations/stores are related to energy for heating and lighting, and waste associated with lost products and packaging.

No energy and waste differentiation are needed between apparel and footwear product sub-categories as usually a variety of products are stored and sold in the same warehouse or retail setting (ambient storage). This gives consistency of the energy inputs per unit sold within the chosen reference flow.

The emissions and resources used by storage systems shall be allocated to the product stored, and the allocation shall be based on the space (in $m^3$) and time (in weeks) occupied by the product. Time-based allocation is based on the storage capacity of the storage location (52 weeks in a year) and the time the product is stored

in this location. Default storage durations in Table 38 shall be used, unless primary data are used.

Space-based allocation is based on the volume of the storage location, which is either a warehouse (**$Volume_{Warehouse}$**) or retail store (**$Volume_{Retail}$**), as well as the average storage shelf height (ShelfHeight) and the shelf coverage of the storage location surface (ShelfCoverage). The default values of 48'000 $m^3$ for $Volume_{Warehouse}$, 2'000 $m^3$ for $Volume_{Retail}$ , 2 m for ShelfHeight and 50% for ShelfCoverage (PEF 2019, 4.4.5 Storage at distribution centre or retail) shall be used unless primary data are used. The product volume stored is defined as the volume of the product including primary packaging ($Volume_{Product}$) and the default values in Table 35 shall be used unless primary data are used. Additionally, a storage volume factor (VolumeFactor) of 4 is used for ambient storage (OEFSRs retail, 2018) to account for the additional space the product takes in the storage facility, meaning the product volume will be multiplied by 4.

The default data (from the PEF method) for electricity consumption, 30 kWh/ $m^2$*year for warehouses ($Consumption_{ElectricityWarehouse}$) and 150 kWh/$m^2$/year for retail stores ($Consumption_{ElectricityRetail}$), and gas consumption, 360 MJ/$m^2$/year for warehouses ($Consumption_{GasWarehouse}$) shall be used for all apparel and footwear sub-categories, unless primary data are used.

If primary data is only partially available for a given distribution scenario process (e.g. storage at retail stores), default data shall be used instead.

The energy consumption shall also take into account the impacts generated by the digital infrastructure (DigitalInfrastructure) used for online shopping in the two e-commerce scenarios (classic e-commerce and F2C). For each product ordered, 0.030 kWh of electricity (European grid mix) are needed based on expert judgement.

The impact linked to energy consumption for storage and distribution for each transport leg [X] is calculated according to Equation 31, using the equation parameters in Table 38.

$$ConsumptionEnergy[X] = \frac{Share[X] * Volume\ stored[X] * StorageTime[X] * StorageSurface[X]}{StorageCapacity[X]} * (Consumption_{Energy}[X])$$

Equation 31

Equation 31 shall be repeated for the calculation of the electricity and the natural gas consumption according to Table 38. The energy consumption for the “other” column shall be added to the electricity consumption where relevant.

Table 38 - Default storage capacity and energy consumption for warehouse/DC and retail/stores

| Transport leg | Volume stored ($m^3$/product) VolumeStored[X] | Default storage time (weeks) StorageTime[X] | Storage capacity ($m^3$ * weeks / year) StorageCapacity[X] | Storage surface (m2) StorageSurface[X] | Storage energy consumption (kWh/m2/year or MJ/m2/year) Consumption[X] | Other (kWh / product) Other[X] |
|---|---|---|---|---|---|---|
| [1a1] [1a3] | N/A | N/A | N/A | N/A | N/A | $DigitalInfrastructure$ |
| [1a2] | $Volume_{Product} * VolumeFactor$ | 7 / 2 = 3.5 weeks+ | $Volume_{Warehouse} * 52\ weeks\ /\ year$ | $\frac{Volume_{Warehouse} * ShelfCoverage}{ShelfHeight}$ | $Consumption_{Electricity_{Warehouse}} + Consumption_{Gas_{Warehouse}}$ | N/A |
| [1c] | N/A | N/A | N/A | N/A | N/A | N/A |
| [2a1] [2a2] | $Volume_{Product} * VolumeFactor$ | 7 / 2 = 3.5 weeks+ | $Volume_{Warehouse} * 52\ weeks\ /\ year$ | $\frac{Volume_{Warehouse} * ShelfCoverage}{ShelfHeight}$ | $Consumption_{Electricity_{Warehouse}} + Consumption_{Gas_{Warehouse}}$ | N/A |
| [2b1] [2b2] | $Volume_{Product} * VolumeFactor$ | 3 years = 156 weeks++ | $Volume_{Warehouse} * 52\ weeks\ /\ year$ | $\frac{Volume_{Warehouse} * ShelfCoverage}{ShelfHeight}$ | $Consumption_{Electricity_{Warehouse}} + Consumption_{Gas_{Warehouse}}$ | N/A |
| [2c1] [2c2] | N/A | N/A | N/A | N/A | N/A | N/A |
| [3a] | $Volume_{Product} * VolumeFactor$ | 7 / 2 = 3.5 weeks+ | $Volume_{Warehouse} * 52\ weeks\ /\ year$ | $\frac{Volume_{Warehouse} * ShelfCoverage}{ShelfHeight}$ | $Consumption_{Electricity_{Warehouse}} + Consumption_{Gas_{Warehouse}}$ | N/A |
| [3b] | N/A | N/A | N/A | N/A | N/A | N/A |
| [3c] | N/A | N/A | N/A | N/A | N/A | N/A |
| [3d] | N/A | N/A | N/A | N/A | N/A | N/A |
| [4a] | $Volume_{Product} * VolumeFactor$ | 7 / 2 = 3.5 weeks+ | $Volume_{Retail} * 52\ weeks\ /\ year$ | $\frac{Volume_{Retail} * ShelfCoverage}{ShelfHeight}$ | $Consumption_{Electricity_{Retail}}$ | N/A |
| [4b] | N/A | N/A | N/A | N/A | N/A | $DigitalInfrastructure$ |
| [4c] | N/A | N/A | N/A | N/A | N/A | N/A |
| [4d] | N/A | N/A | N/A | N/A | N/A | N/A |

+ Based on OEFSRs retail, 2018, and data received

++ According to unsold consumer products definition from Section 6.1.1

### 6.3.5 Repair distribution

When a repairability multiplier as defined in Section 3.3.4 is used, transport shall be calculated according to transport legs [4b2] + [4b3] described in Section 6.3.1, accounting for the return trip of the retail to consumer transportation.

As a proxy, the percentage of products being repaired shall match the repairability multiplier.
For example, if the repairability multiplier is 1.05 (105%), additional transportation impacts for 10% (5% transported one way then the other) shall be included.

### 6.3.6 Packaging production, reuse and end of life

The production of packaging shall be modelled in LCS1. The type and amount of packaging materials shall be determined according to Section 6.1.5. The end of life of the primary packaging shall be accounted for in LCS5, while it shall be accounted for in LCS3 for secondary and tertiary packaging. The burdens and credits of the end of life of packaging shall be allocated using the CFF, presented in Section 5.10, using the default parameters available in the latest version of Part C of Annex II of the PEF method.

## 6.4 Use stage

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

This PEFCR uses the main function approach. The use stage for apparel considers impacts related to the following steps for most of the sub-categories:

- Washing and cleaning
- Drying
- Ironing and steaming

These processes of the apparel use stage are product dependent.
The impacts related to the following steps are considered for footwear:

- Care

The product weight considered for the use phase shall only include the weight of the product. Further details on material-specific requirements for the use stage per each representative product are described below.

For apparel products, the care label typically provides washing instructions. While the care label shows instructions such as the maximum temperature a product can withstand, this does not necessarily mean that the product is washed at that temperature, it may in fact be washed at a lower temperature. Similarly, a product may not be ironed even if the care label indicates an ironing temperature. For this reason, the use stage shall be modelled using the default values presented in the sections below.

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. kg of product). Where such data are not available, the average EU consumption mix (EU27 + UK + EFTA), or region-representative consumption mix, shall be used.

Default datasets for the use stage can be found in ANNEX VII – Inventory modelling and default datasets (“Default datasets & DQR” tab).

### 6.4.1 Washing / cleaning

According to the PEFCR for leather (Leather PEFCR, 2020), specific garment use instructions shall be followed for genuine leather and genuine fur products and modelled accordingly. In general, genuine leather and genuine fur articles will not be washed, dried, ironed or steamed. Delicate garments are defined as items requiring dry cleaning only based on their care label (FHCM, 2019).

**Washing types and temperatures**

The default washing types and typical washing temperatures provided in Table 39 below (Laitala, 2020, Cotton Incorporated, 2020) shall be used for all apparel sub-categories, except for delicate garments where 100% dry cleaning shall be modelled.

The default temperature corresponds to the temperature of the main washing type, for example for underwear with the main washing type being washing machine and the default temperature being set to 60°C.

In case of blends, please refer to the material having the highest share in the mix. If no material is identified as such, then the “all materials” product details section shall be used.

Table 39 - Default washing types and specific instructions

| No. | Product sub-category | Product details | Temp. (°C) | % Hand-washing | % Machine washing | % Dry cleaning |
|---|---|---|---|---|---|---|
| 1 | T-shirts | **All materials** | **40°C** | **6%** | **89%** | **5%** |
| | | Cotton and blends | 40°C | 8% | 90% | 2% |
| | | Wool, blends and silk | 30°C | 18% | 57% | 25% |
| | | Synthetics | 40°C | 9% | 88% | 3% |
| | | Regen. cellulose | 40°C | 22% | 73% | 5% |
| 2 | Shirts and blouses | **All materials** | **40°C** | **8%** | **81%** | **11%** |
| 3 | Sweaters and midlayers | **All materials** | **30°C** | **22%** | **64%** | **14%** |
| 4 | Jackets and coats | **All materials** | **40°C** | **20%** | **60%** | **20%** |
| | | Cotton and blends | 40°C | 13% | 63% | 25% |
| | | Wool, blends and silk | 30°C | 13% | 24% | 64% |
| | | Synthetics | 40°C | 13% | 61% | 26% |
| | | Regen. cellulose | 40°C | 16% | 65% | 18% |
| 5 | Pants and shorts | **All materials** | **40°C** | **6%** | **75%** | **19%** |
| | | Cotton and blends | 40°C | 13% | 63% | 25% |
| | | Wool, blends and silk | 30°C | 13% | 24% | 64% |
| | | Synthetics | 40°C | 13% | 61% | 26% |
| | | Regen. cellulose | 40°C | 16% | 65% | 18% |
| 6 | Dresses, skirts and jumpsuits | **All materials** | **40°C** | **17%** | **69%** | **14%** |
| 7 | Leggings, stockings, tights and socks | **All materials** | **40°C** | **10%** | **85%** | **5%** |
| | | Cotton and blends | 40°C | 16% | 83% | 1% |
| | | Wool, blends and silk | 30°C | 25% | 66% | 10% |
| | | Synthetics | 40°C | 24% | 75% | 1% |
| | | Regen. cellulose | 40°C | 47% | 50% | 2% |
| 8 | Underwear | **All materials** | **60°C** | **12%** | **86%** | **2%** |
| 9 | Swimwear | **All materials** | **30°C** | **100%** | **0%** | **0%** |
| 10 | | **All materials** | **30°C** | **29%** | **47%** | **24%** |

| No. | Product sub-category | Product details | Temp. (°C) | % Hand-washing | % Machine washing | % Dry cleaning |
|---|---|---|---|---|---|---|
| | Apparel accessories | Hat | 30°C | 29% | 56% | 14% |
| | | Scarves | 30°C | 28% | 33% | 39% |
| | | Gloves | 30°C | 28% | 59% | 13% |
| | | Belts | n/a | n/a | n/a | n/a |

Numbers may not always add up to 100% because of rounding.

This table does not apply to genuine leather and genuine fur products.

The default washing datasets from the EF database reported in ANNEX VII – Inventory modelling and default datasets (“Default datasets & DQR” tab) shall be used.

**Washing frequency**

The default frequency of washing presented in Table 40 below (key data for a standard consumer, based on data from Laitala (2020), Sandin (2019), and Daystar (2019)) shall be used.

Table 40 - Number of uses between washes.

For the segmentation between sport and non-sport, please refer to Section 3.3.3.1

| No. | Sub-category | Fibre type | Average uses prior to washing | Average uses prior to washing for sport segment | Average uses prior to washing for delicates |
|---|---|---|---|---|---|
| RP 1 | T-shirts | > 50% animal fibre | 3 | 1 | 3 |
| | | Other fibres | 2 | 1 | |
| RP 2 | Shirts and blouses | All types | 2 | 1.5 | 5 |
| RP 3 | Sweaters and midlayers | > 50% animal fibre | 10 | 1.5 | 10 |
| | | Other fibres | 6 | 1.5 | |
| RP 4 | Jackets and coats | All fibres | 20 | 1.5 | 5 |
| RP 5 | Pants and shorts | > 50% animal fibre | 7 | 1.5 | 7 |
| | | Other fibres | 5 | 1.5 | |
| RP 6 | Dresses, skirts and jumpsuits | All fibres | 3 | 1.5 | 5 |
| RP 7 | Leggings, stockings, tights and socks | > 50% animal fibre | 3 | 1.5 | 3 |
| | | Other fibres | 2 | 1.5 | |
| RP 8 | Underwear | All fibres | 1 | 1 | 1 |
| RP 9 | Swimwear | All fibres | 1 | 1 | 5 |
| RP 10 | Apparel accessories | All fibres | 20 | 20 | 20 |

This table does not apply to genuine leather and genuine fur products. Products in the sport segment are intended primarily for use in an organized or individual capacity related to physical activity and designed with functional elements specifically for the intended use and practiced activity. Product appearance shall not be the sole characteristic evaluated to determine the inclusion in this segment.

### 6.4.2 Drying

The default frequency of drying indicated in Table 41 (Laitala, 2018a, 2020, Gore 2016) shall be used for all apparel sub-categories, even for products whose care label would not recommend tumble drying. This table is built on average tumble-drying rates, taking into account garments that are only air dried (e.g. made of wool, delicates, etc).

Table 41 - Data for drying per product sub-category

| No. | Sub-category | Air drying | Tumble drying |
|---|---|---|---|
| 1 | T-shirts | 70% | 30% |
| 2 | Shirts and blouses | 88% | 12% |
| 3 | Sweaters and midwear | 70% | 30% |
| 4 | Jackets and coats | 75% | 25% |
| 5 | Pants and shorts | 70% | 30% |
| 6 | Dresses, skirts and jumpsuits | 88% | 12% |
| 7 | Leggings, stockings, tights and socks | 88% | 12% |
| 8 | Underwear | 65% | 35% |
| 9 | Swimwear | 88% | 12% |
| 10 | Apparel accessories | 88% | 12% |

This table does not apply to genuine leather and genuine fur products.

### 6.4.3 Ironing / steaming

The default ironing and steaming data presented in Table 42 (Laitala, 2018a; Daystar, 2019; Sandin, 2019) shall be used for all apparel sub-categories, even for products whose care label would not recommend ironing or steaming. Values provided in the table below are representative of ironing per cleaning cycle, taking into account garments that are not ironed (e.g. made of wool, delicates, etc). Therefore ironing is assumed after each wash.

The default ironing / steaming datasets from the EF database reported in ANNEX VII – Inventory modelling and default datasets ("Default datasets & DQR" tab) shall be used.

Table 42 - Data for ironing and steaming

| No. | Sub-category | % of garments ironed or steamed per use | Time spent per garment (min) |
|---|---|---|---|
| 1 | T-shirts | 40% | 2.6 |
| 2 | Shirts and blouses | 70% | 2.6 |
| 3 | Sweaters and midlayers | 0% | n/a |
| 4 | Jackets and coats | 5% | 4 |
| 5 | Pants and shorts | 63% | 4.3 |
| 6 | Dresses, skirts and jumpsuits | 18% | 4.5 |
| 7 | Leggings, stockings, tights and socks | 5% | 3.4 |
| 8 | Underwear | 1% | 1 |

| No. | Sub-category | % of garments ironed or steamed per use | Time spent per garment (min) |
|---|---|---|---|
| 9 | Swimwear | 0% | n/a |
| 10 | Apparel accessories | 25% | 2.0 |

This table does not apply to genuine leather and genuine fur products.

### 6.4.4 Footwear care

Footwear care is twofold: washing and waxing. Washing concerns all footwears labelled as textiles (EU Footwear Labelling Directive) while waxing concerns non-textile closed-toed shoes and boots only.

While washing footwear in a washing machine is discouraged by footwear brands, it is assumed that consumers wash their shoes once during the shoe's lifetime (Cascale and thinkstep, 2016), using a dedicated delicate cycle. Footwear products are considered to be left to air dry, hence no tumble drying shall be modelled.

No data on the frequency of waxing being available, a conservative approach has been used and 100% of closed-toed shoes and boots are receiving care every 10 uses (expert judgement). 0.002 kg of wax/ kg of footwear shall be used for the modelling.

Table 43 - Data for footwear care

| Type of care | Frequency | Value | Dataset |
|---|---|---|---|
| Washing (RP 11, 12 & 13) | Once per lifetime | Mass of the footwear | Washing, 30°, average washing, cold to warm water production mix, at plant service |
| Waxing (RP 12 & 13) | Every 10 uses | 0.002 kg/ kg of footwear | Wax production technology mix production mix, at plant 100% active substance |

### 6.4.5 Repairability and use stage modelling

When a repairability multiplier as defined in Section 3.3.4 is used, the impact of the repair shall be modelled using the apparel or footwear repair for reuse dataset.

As a proxy, the percentage of products being repaired shall match the repairability multiplier.

For example, if the repairability multiplier is 1.05 (105%), repair impacts shall be included for 5% of the product.

### 6.4.6 Extended lifetime and circularity

According to Section 4.4.9 of the PEF method (2021), if a product is re-used with the same specifications (same function), this re-use shall be considered as an extension of the use stage of the product. The aspects related to this lifetime extension are discussed in Section 3.3.2

According to the PEF method:
The following processes are excluded from the use stage:
(d) **If a product is reused** (see also Section 4.4.9.2), the processes needed to collect the product and make it ready for the new use cycle are excluded (e.g. the impacts from collection and cleaning reusable bottles). These processes are included in the EoL stage if the product is reused into a product with different specifications (see Section 4.4.9 for further details). If the product lifetime is extended into a product with original product specifications (providing the same function) these processes shall be included in the FU and reference flow.

## 6.5 End of life

The end of life stage begins when the product in scope and its packaging is discarded by the user and ends when the product is returned to nature as a waste product or enters another product's life cycle (i.e. as a recycled input). In general, it includes the waste of the product in scope, such as the food waste, and primary packaging.

Other waste (different from the product in scope) generated during the manufacturing, distribution, retail, use stage or after use shall be included in the life cycle of the product and modelled at the life cycle stage where it occurs.

Default datasets for the end-of-life stage can be found in ANNEX VII – Inventory modelling and default datasets ("Default datasets & DQR" tab).

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

The end of life shall be modelled using the Circular Footprint Formula and rules provided in chapter 'End of life modelling' of this PEFCR and in the PEF method, together with the default parameters listed in Table 21 to Table 23.

Before selecting the appropriate R2 value, the user of the PEFCR shall carry out an evaluation for recyclability of the material. The PEF study shall include a statement on the recyclability of the materials/ products. The statement on 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.

Following the evaluation for recyclability, the appropriate R2 values (supply-chain specific or default) shall be used. If one criterion is not fulfilled or the sector-specific recyclability guidelines indicate limited recyclability, an R2 value of 0% shall be applied.

Company-specific R2 values (measured at the output of the recycling plant) shall be used, if available. If no company-specific values are available and the criteria for the evaluation of recyclability are fulfilled (see below), application-specific R2 values shall be used as listed in Table 21 to Table 23.

- If an R2 value is not available for a specific country, the European average shall be used.
- If an R2 value is not available for a specific application, the R2 values of the material shall be used (e.g. materials average).
- In case no R2 values are available, R2 shall be set equal to 0 or new statistics may be generated in order to assign an R2 value in the specific situation.

The applied R2 values shall be subject to the PEF study verification.

Instructions on end-of-life modelling can mostly be found in other sections of the PEFCR:

- An extension of lifetime (for example through reuse) is not considered to be an end-of-life scenario. More information can be found in Section 3.3.2;
- The modelling of the end-of-life scenario should include the transportation, collection and sorting when applicable, and follow the CFF formula, as presented in Section 5.10.

The end-of-life fate of unsold consumer products (Section 6.2.3) shall be modelled using the default end-of-life assumptions for the product illustrated in Figure 8 and Figure 9 of Section 5.10.

In case a take back program is in place, the user of the PEFCR shall adapt all the end of life parameters of the CFF (R2, R3, A and B) as well as the datasets if relevant (transport modes, distance of collect, Erec, Ev, Ev*, etc.) according to the rules defined in Section 5.10. In case some end-of-life parameters of the CFF or datasets cannot be updated because lack of data, the user of the CFF shall use the default end of life scenario from Figure 8 and Figure 9.

### 6.5.1 Collection and transport

The default datasets proposed in Annex VII for the disposal of primary packaging already include the collection of the packaging at the end of life.

At the end of life, apparel and footwear products are either directly disposed of through municipal waste collection or collected prior to being sorted and treated as shown in Figure 14 for apparel and Figure 15 for footwear.

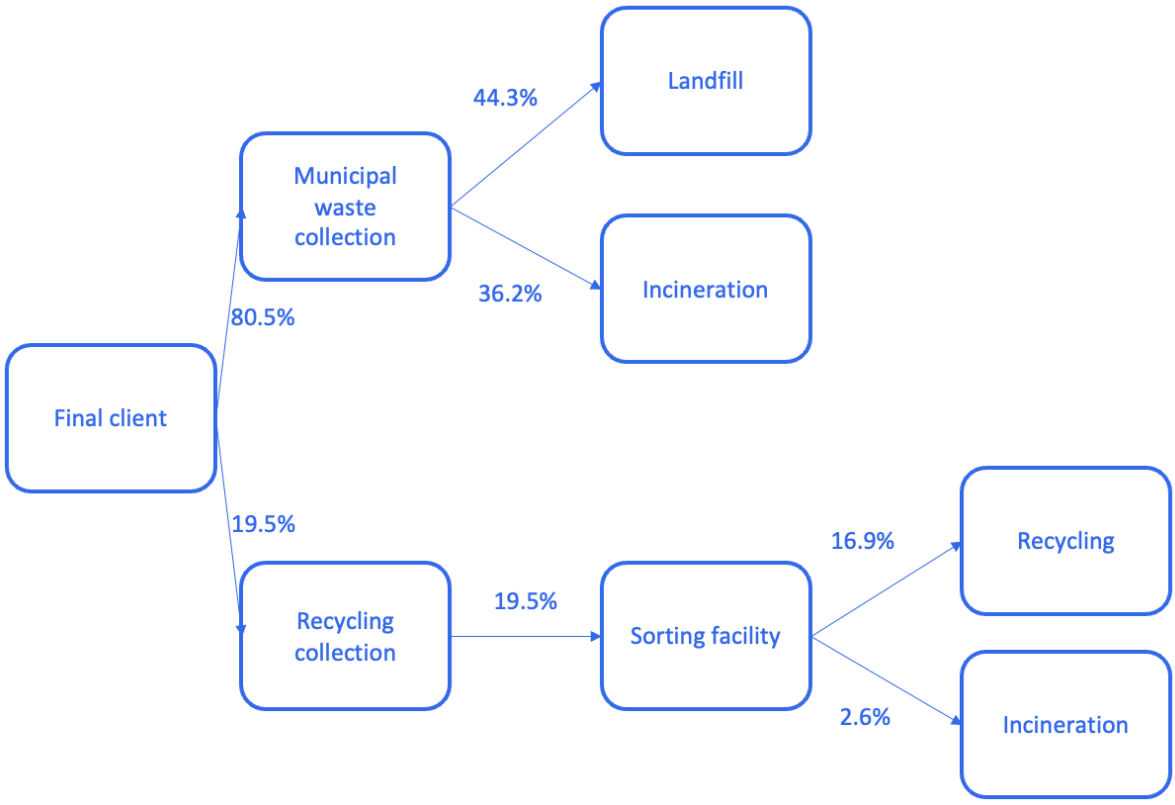



Figure 14 - End-of-life fate scenarios for apparel

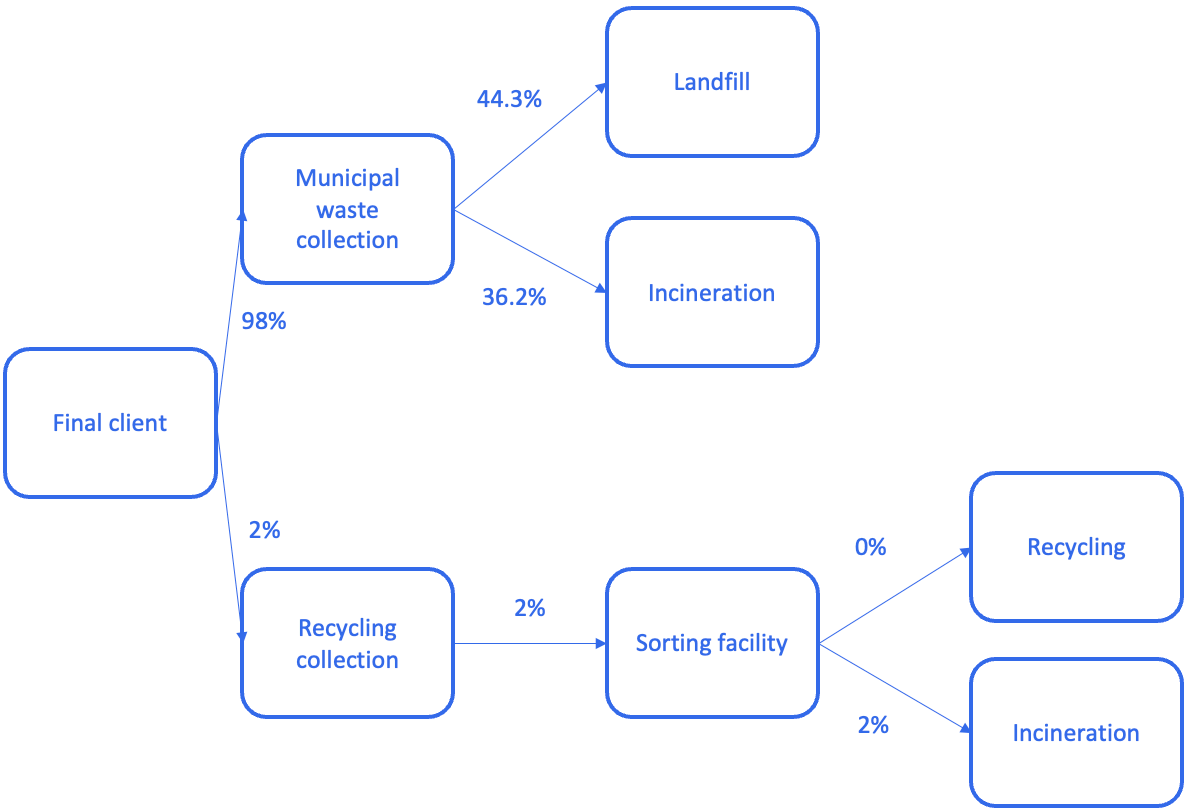



Figure 15 - End-of-life fate scenarios for footwear

For the transport from the client to the recycling collection point, the allocation factor is calculated as the volume of the product divided by the maximum volume (0.2 $m^3$ for a passenger car), as presented in Table 44.

Table 44 - Default representative product volumes

| No. | Sub-category | Default product volume ($m^3$) | Allocation |
|---|---|---|---|
| 1 | T-shirts | 0.0018 | 0.009 |
| 2 | Shirts and blouses | 0.006 | 0.03 |
| 3 | Sweaters and midlayers | 0.0102 | 0.051 |
| 4 | Jackets and coats | 0.015 | 0.075 |
| 5 | Pants and shorts | 0.004 | 0.02 |
| 6 | Dresses, skirts and jumpsuits | 0.007 | 0.035 |
| 7 | Leggings, stockings, tights and socks | 0.0006 | 0.003 |
| 8 | Underwear | 0.0006 | 0.003 |
| 9 | Swimwear | 0.0006 | 0.003 |
| 10 | Apparel accessories | 0.0012 | 0.006 |
| 11 | Open-toed shoes | 0.0048 | 0.024 |
| 12 | Closed-toed shoes | 0.018 | 0.09 |
| 13 | Boots | 0.024 | 0.12 |

The default transport means and distances presented in Table 45 for apparel and Table 46 for footwear shall be used (PEF method) unless primary data are used. The collection rate is based on the percentages specified in the tables integrated in Figure 8 and Figure 9 (column “end-of-life excluding the reuse rate”).

Table 45 - Default transport parameters for apparel end of life. See Figure 14 for more details.

| Supply chain | Distance (km) | Utilisation ratio | Share of product mass transported for each transport leg (%) | Transportation mode |
|---|---|---|---|---|
| **Municipal waste collection** | | | | |
| Final client to landfill | 30 | 64% | 80.5% | Truck (>32 t, EURO 4) |
| Final client to incineration | 30 | 64% | 80.5% | Truck (>32 t, EURO 4) |
| **Recycling collection** | | | | |
| Final client to collection point | 1 | n/a | 19.5% | Passenger car |
| Collection point to sorting point | 130 | 64% | 19.5% | Truck (>32 t, EURO 4) |
| | 240 | n/a | | Train (average freight train) |
| | 270 | n/a | | Ship (barge) |
| Sorting point to recycling | 100 | 64% | 16.9% | Truck (>32 t, EURO 4) |
| Sorting point to incineration | 30 | 64% | 2.6% | Truck (>32 t, EURO 4) |

Table 46 - Default transport parameters for footwear end of life. See Figure 15 for more details.

| Supply chain | Distance (km) | Utilisation ratio | Share of product mass transported for each transport leg (%) | Transportation mode |
|---|---|---|---|---|
| **Municipal waste collection** | | | | |
| Final client to landfill | 30 | 64% | 98% | Truck (>32 t, EURO 4) |
| Final client to incineration | 30 | 64% | 98% | Truck (>32 t, EURO 4) |
| **Recycling collection** | | | | |
| Final client to collection point | 1 | n/a | 2% | Passenger car |
| Collection point to sorting point | 130 | 64% | 2% | Truck (>32 t, EURO 4) |
| | 240 | n/a | | Train (average freight train) |
| | 270 | n/a | | Ship (barge) |
| Sorting point to recycling | 100 | 64% | 0% | Truck (>32 t, EURO 4) |
| Sorting point to incineration | 30 | 64% | 2% | Truck (>32 t, EURO 4) |

# 7 PEF results

## 7.1 Benchmark values

The characterised, normalised, and weighted results including the weighted results as a single score for the 13 representative products (RPs) are presented in Table 47 through Table 59 for each impact category. To reduce the number of tables and improve the readability of this PEFCR, all results per each representative product were summarized in one table.
The sub-categories ‘climate change –fossil’, ‘climate change – biogenic’ and ‘climate change - land use and land use change’, are reported separately if they show a contribution of more than 5% each to the total score of climate change.

The data used for the models of the representative product were the best available data at the time of modelling them for the PEFCR. The definition of the sub-categories leads to variability of the products, with different functions within each sub-category. Accordingly, as is the case for all LCA methodologies, the conclusions drawn from a comparison to the benchmark have a degree of uncertainty and should, therefore, be seen as indications with some limitations.

This PEFCR does not allow the use of single score results for making business to consumer comparisons and comparative assertions between the product under study and the benchmarks provided in Section 7.1, as described in Section 7.4. Only characterized results for at least the first four most relevant indicators shall be used as a basis for these comparisons and comparative assertions.

Table 47 - Characterised, normalised and weighted results including the single score per use for t-shirts (RP1)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 1.76E-01 | 1.96E-01 | Person-years | 2.33E-05 | 2.59E-05 | Points | 4.9E-06 | 5.5E-06 |
| Climate change - Fossil | kg $CO_2$ eq | 1.69E-01 | 1.86E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 4.60E-03 | 4.99E-03 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 2.74E-03 | 4.41E-03 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 1.81E-09 | 2.86E-09 | Person-years | 3.46E-08 | 5.47E-08 | Points | 2.2E-09 | 3.5E-09 |
| Human toxicity, cancer | CTUh | 2.54E-10 | 2.80E-10 | Person-years | 1.47E-05 | 1.62E-05 | Points | 3.1E-07 | 3.5E-07 |
| Human toxicity, non-cancer | CTUh | 2.85E-09 | 3.09E-09 | Person-years | 2.22E-05 | 2.40E-05 | Points | 4.1E-07 | 4.4E-07 |
| Particulate matter | disease inc. | 2.99E-08 | 3.13E-08 | Person-years | 5.03E-05 | 5.25E-05 | Points | 4.5E-06 | 4.7E-06 |
| Ionising radiation | kBq U-235 eq | 9.10E-03 | 1.41E-02 | Person-years | 2.16E-06 | 3.33E-06 | Points | 1.1E-07 | 1.7E-07 |
| Photochemical ozone formation | kg NMVOC eq | 6.72E-04 | 7.18E-04 | Person-years | 1.65E-05 | 1.76E-05 | Points | 7.9E-07 | 8.4E-07 |
| Acidification | mol $H^+$ eq | 1.32E-03 | 1.40E-03 | Person-years | 2.38E-05 | 2.51E-05 | Points | 1.5E-06 | 1.6E-06 |
| Eutrophication, terrestrial | mol N eq | 3.96E-03 | 4.14E-03 | Person-years | 2.24E-05 | 2.34E-05 | Points | 8.3E-07 | 8.7E-07 |
| Eutrophication, freshwater | kg P eq | 4.44E-05 | 4.64E-05 | Person-years | 2.77E-05 | 2.88E-05 | Points | 7.7E-07 | 8.1E-07 |
| Eutrophication, marine | kg N eq | 6.33E-04 | 6.68E-04 | Person-years | 3.24E-05 | 3.42E-05 | Points | 9.6E-07 | 1.0E-06 |
| Ecotoxicity, freshwater | CTUe | 2.05E+00 | 2.27E+00 | Person-years | 3.62E-05 | 4.00E-05 | Points | 7.0E-07 | 7.7E-07 |
| Land use | Pt | 6.19E+00 | 6.64E+00 | Person-years | 7.55E-06 | 8.10E-06 | Points | 6.0E-07 | 6.4E-07 |
| Water use | $m^3$ depriv. | 6.96E-01 | 7.11E-01 | Person-years | 6.07E-05 | 6.20E-05 | Points | 5.2E-06 | 5.3E-06 |
| Resource use, minerals and metals | kg Sb eq | 1.23E-06 | 1.55E-06 | Person-years | 1.93E-05 | 2.44E-05 | Points | 1.5E-06 | 1.8E-06 |
| Resource use, fossils | MJ | 2.28E+00 | 2.57E+00 | Person-years | 3.51E-05 | 3.95E-05 | Points | 2.9E-06 | 3.3E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **2.6E-05** | **2.8E-05** |

Table 48 - Characterised, normalised and weighted results including the single score per use for shirts and blouses (RP2)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 3.07E-01 | 3.34E-01 | Person-years | 4.07E-05 | 4.42E-05 | Points | 8.6E-06 | 9.3E-06 |
| Climate change - Fossil | kg $CO_2$ eq | 2.97E-01 | 3.20E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 6.97E-03 | 7.51E-03 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 3.57E-03 | 5.81E-03 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 2.70E-09 | 5.88E-09 | Person-years | 5.16E-08 | 1.12E-07 | Points | 3.3E-09 | 7.1E-09 |
| Human toxicity, cancer | CTUh | 4.09E-10 | 4.47E-10 | Person-years | 2.37E-05 | 2.59E-05 | Points | 5.0E-07 | 5.5E-07 |
| Human toxicity, non-cancer | CTUh | 4.15E-09 | 4.49E-09 | Person-years | 3.22E-05 | 3.49E-05 | Points | 5.9E-07 | 6.4E-07 |
| Particulate matter | disease inc. | 5.37E-08 | 5.55E-08 | Person-years | 9.02E-05 | 9.32E-05 | Points | 8.1E-06 | 8.3E-06 |
| Ionising radiation | kBq U-235 eq | 1.82E-02 | 2.47E-02 | Person-years | 4.32E-06 | 5.85E-06 | Points | 2.2E-07 | 2.9E-07 |
| Photochemical ozone formation | kg NMVOC eq | 1.09E-03 | 1.16E-03 | Person-years | 2.67E-05 | 2.83E-05 | Points | 1.3E-06 | 1.4E-06 |
| Acidification | mol $H^+$ eq | 2.17E-03 | 2.27E-03 | Person-years | 3.90E-05 | 4.09E-05 | Points | 2.4E-06 | 2.5E-06 |
| Eutrophication, terrestrial | mol N eq | 5.93E-03 | 6.20E-03 | Person-years | 3.35E-05 | 3.51E-05 | Points | 1.2E-06 | 1.3E-06 |
| Eutrophication, freshwater | kg P eq | 5.73E-05 | 5.97E-05 | Person-years | 3.57E-05 | 3.72E-05 | Points | 1.0E-06 | 1.0E-06 |
| Eutrophication, marine | kg N eq | 8.80E-04 | 9.31E-04 | Person-years | 4.50E-05 | 4.76E-05 | Points | 1.3E-06 | 1.4E-06 |
| Ecotoxicity, freshwater | CTUe | 3.05E+00 | 3.35E+00 | Person-years | 5.37E-05 | 5.90E-05 | Points | 1.0E-06 | 1.1E-06 |
| Land use | Pt | 8.28E+00 | 8.92E+00 | Person-years | 1.01E-05 | 1.09E-05 | Points | 8.0E-07 | 8.6E-07 |
| Water use | $m^3$ depriv. | 9.01E-01 | 9.22E-01 | Person-years | 7.85E-05 | 8.04E-05 | Points | 6.7E-06 | 6.8E-06 |
| Resource use, minerals and metals | kg Sb eq | 2.13E-06 | 2.47E-06 | Person-years | 3.34E-05 | 3.88E-05 | Points | 2.5E-06 | 2.9E-06 |
| Resource use, fossils | MJ | 4.07E+00 | 4.44E+00 | Person-years | 6.26E-05 | 6.83E-05 | Points | 5.2E-06 | 5.7E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **4.1E-05** | **4.4E-05** |

Table 49 - Characterised, normalised and weighted results including the single score per use for sweaters and midlayers (RP3)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 8.57E-01 | 8.75E-01 | Person-years | 1.13E-04 | 1.16E-04 | Points | 2.39E-05 | 2.44E-05 |
| Climate change - Fossil | kg $CO_2$ eq | 5.24E-01 | 5.40E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 2.43E-01 | 2.44E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 8.97E-02 | 9.09E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 3.04E-09 | 5.74E-09 | Person-years | 5.81E-08 | 1.10E-07 | Points | 3.67E-09 | 6.91E-09 |
| Human toxicity, cancer | CTUh | 4.76E-10 | 5.08E-10 | Person-years | 2.76E-05 | 2.95E-05 | Points | 5.88E-07 | 6.27E-07 |
| Human toxicity, non-cancer | CTUh | 1.09E-08 | 1.12E-08 | Person-years | 8.47E-05 | 8.70E-05 | Points | 1.56E-06 | 1.60E-06 |
| Particulate matter | disease inc. | 1.53E-07 | 1.54E-07 | Person-years | 2.56E-04 | 2.59E-04 | Points | 2.30E-05 | 2.32E-05 |
| Ionising radiation | kBq U-235 eq | 1.77E-02 | 2.18E-02 | Person-years | 4.20E-06 | 5.15E-06 | Points | 2.11E-07 | 2.58E-07 |
| Photochemical ozone formation | kg NMVOC eq | 1.97E-03 | 2.02E-03 | Person-years | 4.83E-05 | 4.96E-05 | Points | 2.31E-06 | 2.37E-06 |
| Acidification | mol $H^+$ eq | 1.57E-02 | 1.58E-02 | Person-years | 2.83E-04 | 2.85E-04 | Points | 1.76E-05 | 1.77E-05 |
| Eutrophication, terrestrial | mol N eq | 6.08E-02 | 6.10E-02 | Person-years | 3.44E-04 | 3.45E-04 | Points | 1.28E-05 | 1.28E-05 |
| Eutrophication, freshwater | kg P eq | 1.60E-04 | 1.62E-04 | Person-years | 9.95E-05 | 1.01E-04 | Points | 2.79E-06 | 2.82E-06 |
| Eutrophication, marine | kg N eq | 8.72E-03 | 8.76E-03 | Person-years | 4.46E-04 | 4.48E-04 | Points | 1.32E-05 | 1.33E-05 |
| Ecotoxicity, freshwater | CTUe | 5.27E+01 | 5.30E+01 | Person-years | 9.29E-04 | 9.34E-04 | Points | 1.78E-05 | 1.79E-05 |
| Land use | Pt | 1.38E+02 | 1.39E+02 | Person-years | 1.69E-04 | 1.69E-04 | Points | 1.34E-05 | 1.34E-05 |
| Water use | $m^3$ depriv. | 1.72E+00 | 1.74E+00 | Person-years | 1.50E-04 | 1.52E-04 | Points | 1.28E-05 | 1.29E-05 |
| Resource use, minerals and metals | kg Sb eq | 2.61E-06 | 2.88E-06 | Person-years | 4.10E-05 | 4.53E-05 | Points | 3.10E-06 | 3.42E-06 |
| Resource use, fossils | MJ | 5.10E+00 | 5.37E+00 | Person-years | 7.84E-05 | 8.26E-05 | Points | 6.53E-06 | 6.87E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **1.51E-04** | **1.54E-04** |

Table 50 - Characterised, normalised and weighted results including the single score per use for jackets and coats (RP4)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 7.40E-01 | 7.51E-01 | Person-years | 9.80E-05 | 9.95E-05 | Points | 2.06E-05 | 2.10E-05 |
| Climate change - Fossil | kg $CO_2$ eq | 5.66E-01 | 5.76E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 1.24E-01 | 1.24E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 5.03E-02 | 5.09E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 4.51E-09 | 6.67E-09 | Person-years | 8.61E-08 | 1.27E-07 | Points | 5.44E-09 | 8.03E-09 |
| Human toxicity, cancer | CTUh | 6.37E-10 | 6.56E-10 | Person-years | 3.69E-05 | 3.80E-05 | Points | 7.86E-07 | 8.10E-07 |
| Human toxicity, non-cancer | CTUh | 8.54E-09 | 8.70E-09 | Person-years | 6.63E-05 | 6.76E-05 | Points | 1.22E-06 | 1.24E-06 |
| Particulate matter | disease inc. | 1.33E-07 | 1.34E-07 | Person-years | 2.23E-04 | 2.24E-04 | Points | 2.00E-05 | 2.01E-05 |
| Ionising radiation | kBq U-235 eq | 2.65E-02 | 2.92E-02 | Person-years | 6.27E-06 | 6.91E-06 | Points | 3.14E-07 | 3.46E-07 |
| Photochemical ozone formation | kg NMVOC eq | 2.03E-03 | 2.06E-03 | Person-years | 4.97E-05 | 5.04E-05 | Points | 2.38E-06 | 2.41E-06 |
| Acidification | mol $H^+$ eq | 1.06E-02 | 1.07E-02 | Person-years | 1.91E-04 | 1.92E-04 | Points | 1.19E-05 | 1.19E-05 |
| Eutrophication, terrestrial | mol N eq | 3.71E-02 | 3.72E-02 | Person-years | 2.10E-04 | 2.11E-04 | Points | 7.79E-06 | 7.82E-06 |
| Eutrophication, freshwater | kg P eq | 9.84E-05 | 9.94E-05 | Person-years | 6.12E-05 | 6.18E-05 | Points | 1.71E-06 | 1.73E-06 |
| Eutrophication, marine | kg N eq | 4.95E-03 | 4.97E-03 | Person-years | 2.53E-04 | 2.54E-04 | Points | 7.49E-06 | 7.53E-06 |
| Ecotoxicity, freshwater | CTUe | 2.94E+01 | 2.95E+01 | Person-years | 5.18E-04 | 5.20E-04 | Points | 9.94E-06 | 9.99E-06 |
| Land use | Pt | 6.18E+01 | 6.21E+01 | Person-years | 7.55E-05 | 7.58E-05 | Points | 5.99E-06 | 6.01E-06 |
| Water use | $m^3$ depriv. | 1.15E+00 | 1.16E+00 | Person-years | 1.01E-04 | 1.01E-04 | Points | 8.56E-06 | 8.63E-06 |
| Resource use, minerals and metals | kg Sb eq | 5.24E-06 | 5.38E-06 | Person-years | 8.24E-05 | 8.46E-05 | Points | 6.22E-06 | 6.39E-06 |
| Resource use, fossils | MJ | 6.94E+00 | 7.11E+00 | Person-years | 1.07E-04 | 1.09E-04 | Points | 8.89E-06 | 9.10E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **1.14E-04** | **1.15E-04** |

Table 51 - Characterised, normalised and weighted results including the single score per use for pants and shorts (RP5)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 3.01E-01 | 3.25E-01 | Person-years | 3.98E-05 | 4.30E-05 | Points | 8.38E-06 | 9.07E-06 |
| Climate change - Fossil | kg $CO_2$ eq | 2.88E-01 | 3.11E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 8.73E-03 | 9.12E-03 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 3.65E-03 | 5.15E-03 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 3.27E-09 | 7.14E-09 | Person-years | 6.25E-08 | 1.36E-07 | Points | 3.94E-09 | 8.61E-09 |
| Human toxicity, cancer | CTUh | 4.07E-10 | 4.42E-10 | Person-years | 2.36E-05 | 2.56E-05 | Points | 5.02E-07 | 5.46E-07 |
| Human toxicity, non-cancer | CTUh | 4.07E-09 | 4.37E-09 | Person-years | 3.16E-05 | 3.40E-05 | Points | 5.82E-07 | 6.25E-07 |
| Particulate matter | disease inc. | 5.23E-08 | 5.38E-08 | Person-years | 8.78E-05 | 9.04E-05 | Points | 7.86E-06 | 8.10E-06 |
| Ionising radiation | kBq U-235 eq | 1.64E-02 | 2.30E-02 | Person-years | 3.89E-06 | 5.46E-06 | Points | 1.95E-07 | 2.73E-07 |
| Photochemical ozone formation | kg NMVOC eq | 1.09E-03 | 1.15E-03 | Person-years | 2.66E-05 | 2.81E-05 | Points | 1.27E-06 | 1.34E-06 |
| Acidification | mol $H^+$ eq | 2.25E-03 | 2.34E-03 | Person-years | 4.04E-05 | 4.22E-05 | Points | 2.51E-06 | 2.61E-06 |
| Eutrophication, terrestrial | mol N eq | 6.26E-03 | 6.50E-03 | Person-years | 3.54E-05 | 3.68E-05 | Points | 1.31E-06 | 1.36E-06 |
| Eutrophication, freshwater | kg P eq | 5.28E-05 | 5.47E-05 | Person-years | 3.29E-05 | 3.41E-05 | Points | 9.21E-07 | 9.54E-07 |
| Eutrophication, marine | kg N eq | 8.77E-04 | 9.18E-04 | Person-years | 4.49E-05 | 4.70E-05 | Points | 1.33E-06 | 1.39E-06 |
| Ecotoxicity, freshwater | CTUe | 3.39E+00 | 3.65E+00 | Person-years | 5.98E-05 | 6.44E-05 | Points | 1.15E-06 | 1.24E-06 |
| Land use | Pt | 7.86E+00 | 8.33E+00 | Person-years | 9.60E-06 | 1.02E-05 | Points | 7.62E-07 | 8.07E-07 |
| Water use | $m^3$ depriv. | 8.13E-01 | 8.30E-01 | Person-years | 7.09E-05 | 7.24E-05 | Points | 6.03E-06 | 6.16E-06 |
| Resource use, minerals and metals | kg Sb eq | 2.76E-06 | 3.07E-06 | Person-years | 4.33E-05 | 4.83E-05 | Points | 3.27E-06 | 3.65E-06 |
| Resource use, fossils | MJ | 4.02E+00 | 4.39E+00 | Person-years | 6.18E-05 | 6.75E-05 | Points | 5.14E-06 | 5.62E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **4.12E-05** | **4.38E-05** |

Table 52 - Characterised, normalised and weighted results including the single score per use for dresses, skirts and jumpsuits (RP6)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 2.29E-01 | 2.49E-01 | Person-years | 3.03E-05 | 3.30E-05 | Points | 6.38E-06 | 6.95E-06 |
| Climate change - Fossil | kg $CO_2$ eq | 2.10E-01 | 2.28E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 1.22E-02 | 1.26E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 6.46E-03 | 8.00E-03 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 1.91E-09 | 5.13E-09 | Person-years | 3.66E-08 | 9.80E-08 | Points | 2.31E-09 | 6.18E-09 |
| Human toxicity, cancer | CTUh | 2.81E-10 | 3.14E-10 | Person-years | 1.63E-05 | 1.82E-05 | Points | 3.47E-07 | 3.88E-07 |
| Human toxicity, non-cancer | CTUh | 3.15E-09 | 3.44E-09 | Person-years | 2.44E-05 | 2.67E-05 | Points | 4.50E-07 | 4.92E-07 |
| Particulate matter | disease inc. | 4.09E-08 | 4.24E-08 | Person-years | 6.87E-05 | 7.12E-05 | Points | 6.16E-06 | 6.38E-06 |
| Ionising radiation | kBq U-235 eq | 1.22E-02 | 1.69E-02 | Person-years | 2.88E-06 | 4.01E-06 | Points | 1.44E-07 | 2.01E-07 |
| Photochemical ozone formation | kg NMVOC eq | 7.79E-04 | 8.33E-04 | Person-years | 1.91E-05 | 2.04E-05 | Points | 9.11E-07 | 9.75E-07 |
| Acidification | mol $H^+$ eq | 2.09E-03 | 2.18E-03 | Person-years | 3.76E-05 | 3.92E-05 | Points | 2.33E-06 | 2.43E-06 |
| Eutrophication, terrestrial | mol N eq | 6.40E-03 | 6.63E-03 | Person-years | 3.62E-05 | 3.75E-05 | Points | 1.34E-06 | 1.39E-06 |
| Eutrophication, freshwater | kg P eq | 4.36E-05 | 4.56E-05 | Person-years | 2.72E-05 | 2.84E-05 | Points | 7.61E-07 | 7.94E-07 |
| Eutrophication, marine | kg N eq | 9.13E-04 | 9.58E-04 | Person-years | 4.67E-05 | 4.90E-05 | Points | 1.38E-06 | 1.45E-06 |
| Ecotoxicity, freshwater | CTUe | 3.89E+00 | 4.14E+00 | Person-years | 6.85E-05 | 7.30E-05 | Points | 1.32E-06 | 1.40E-06 |
| Land use | Pt | 7.94E+00 | 8.44E+00 | Person-years | 9.68E-06 | 1.03E-05 | Points | 7.69E-07 | 8.18E-07 |
| Water use | $m^3$ depriv. | 6.61E-01 | 6.79E-01 | Person-years | 5.76E-05 | 5.92E-05 | Points | 4.90E-06 | 5.04E-06 |
| Resource use, minerals and metals | kg Sb eq | 1.48E-06 | 1.74E-06 | Person-years | 2.33E-05 | 2.73E-05 | Points | 1.76E-06 | 2.06E-06 |
| Resource use, fossils | MJ | 2.82E+00 | 3.10E+00 | Person-years | 4.33E-05 | 4.77E-05 | Points | 3.60E-06 | 3.97E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **3.26E-05** | **3.47E-05** |

Table 53 - Characterised, normalised and weighted results including the single score per use for leggings, stockings, tights and socks (RP7)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 1.21E-01 | 1.33E-01 | Person-years | 1.61E-05 | 1.76E-05 | Points | 3.38E-06 | 3.71E-06 |
| Climate change - Fossil | kg $CO_2$ eq | 1.11E-01 | 1.21E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 7.26E-03 | 7.54E-03 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 3.03E-03 | 4.25E-03 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 1.07E-09 | 1.87E-09 | Person-years | 2.04E-08 | 3.58E-08 | Points | 1.29E-09 | 2.26E-09 |
| Human toxicity, cancer | CTUh | 1.55E-10 | 1.72E-10 | Person-years | 8.97E-06 | 9.98E-06 | Points | 1.91E-07 | 2.12E-07 |
| Human toxicity, non-cancer | CTUh | 1.29E-09 | 1.45E-09 | Person-years | 9.99E-06 | 1.13E-05 | Points | 1.84E-07 | 2.07E-07 |
| Particulate matter | disease inc. | 2.00E-08 | 2.08E-08 | Person-years | 3.35E-05 | 3.49E-05 | Points | 3.00E-06 | 3.13E-06 |
| Ionising radiation | kBq U-235 eq | 5.60E-03 | 8.20E-03 | Person-years | 1.33E-06 | 1.94E-06 | Points | 6.65E-08 | 9.74E-08 |
| Photochemical ozone formation | kg NMVOC eq | 4.35E-04 | 4.65E-04 | Person-years | 1.07E-05 | 1.14E-05 | Points | 5.09E-07 | 5.43E-07 |
| Acidification | mol $H^+$ eq | 1.11E-03 | 1.16E-03 | Person-years | 1.99E-05 | 2.08E-05 | Points | 1.24E-06 | 1.29E-06 |
| Eutrophication, terrestrial | mol N eq | 3.26E-03 | 3.38E-03 | Person-years | 1.84E-05 | 1.91E-05 | Points | 6.84E-07 | 7.10E-07 |
| Eutrophication, freshwater | kg P eq | 1.43E-05 | 1.56E-05 | Person-years | 8.88E-06 | 9.69E-06 | Points | 2.49E-07 | 2.71E-07 |
| Eutrophication, marine | kg N eq | 4.31E-04 | 4.57E-04 | Person-years | 2.20E-05 | 2.34E-05 | Points | 6.52E-07 | 6.91E-07 |
| Ecotoxicity, freshwater | CTUe | 2.13E+00 | 2.27E+00 | Person-years | 3.75E-05 | 4.01E-05 | Points | 7.20E-07 | 7.69E-07 |
| Land use | Pt | 3.08E+00 | 3.42E+00 | Person-years | 3.76E-06 | 4.17E-06 | Points | 2.98E-07 | 3.31E-07 |
| Water use | $m^3$ depriv. | 2.06E-01 | 2.17E-01 | Person-years | 1.80E-05 | 1.89E-05 | Points | 1.53E-06 | 1.61E-06 |
| Resource use, minerals and metals | kg Sb eq | 7.15E-07 | 8.99E-07 | Person-years | 1.12E-05 | 1.41E-05 | Points | 8.48E-07 | 1.07E-06 |
| Resource use, fossils | MJ | 1.57E+00 | 1.73E+00 | Person-years | 2.42E-05 | 2.66E-05 | Points | 2.01E-06 | 2.21E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **1.56E-05** | **1.69E-05** |

Table 54 - Characterised, normalised and weighted results including the single score per use for underwear (RP8)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 7.21E-02 | 9.29E-02 | Person-years | 9.55E-06 | 1.23E-05 | Points | 2.01E-06 | 2.59E-06 |
| Climate change - Fossil | kg $CO_2$ eq | 6.94E-02 | 8.82E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 1.74E-03 | 2.12E-03 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 9.83E-04 | 2.51E-03 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 6.99E-10 | 1.17E-09 | Person-years | 1.33E-08 | 2.24E-08 | Points | 8.42E-10 | 1.41E-09 |
| Human toxicity, cancer | CTUh | 1.02E-10 | 1.27E-10 | Person-years | 5.92E-06 | 7.34E-06 | Points | 1.26E-07 | 1.56E-07 |
| Human toxicity, non-cancer | CTUh | 1.07E-09 | 1.31E-09 | Person-years | 8.31E-06 | 1.02E-05 | Points | 1.53E-07 | 1.87E-07 |
| Particulate matter | disease inc. | 1.22E-08 | 1.36E-08 | Person-years | 2.05E-05 | 2.28E-05 | Points | 1.84E-06 | 2.04E-06 |
| Ionising radiation | kBq U-235 eq | 3.67E-03 | 9.15E-03 | Person-years | 8.69E-07 | 2.17E-06 | Points | 4.35E-08 | 1.09E-07 |
| Photochemical ozone formation | kg NMVOC eq | 2.84E-04 | 3.32E-04 | Person-years | 6.95E-06 | 8.12E-06 | Points | 3.32E-07 | 3.88E-07 |
| Acidification | mol $H^+$ eq | 5.41E-04 | 6.22E-04 | Person-years | 9.73E-06 | 1.12E-05 | Points | 6.04E-07 | 6.94E-07 |
| Eutrophication, terrestrial | mol N eq | 1.57E-03 | 1.77E-03 | Person-years | 8.86E-06 | 9.99E-06 | Points | 3.29E-07 | 3.71E-07 |
| Eutrophication, freshwater | kg P eq | 1.57E-05 | 1.75E-05 | Person-years | 9.74E-06 | 1.09E-05 | Points | 2.73E-07 | 3.06E-07 |
| Eutrophication, marine | kg N eq | 2.42E-04 | 2.78E-04 | Person-years | 1.24E-05 | 1.42E-05 | Points | 3.67E-07 | 4.22E-07 |
| Ecotoxicity, freshwater | CTUe | 8.34E-01 | 1.06E+00 | Person-years | 1.47E-05 | 1.86E-05 | Points | 2.82E-07 | 3.58E-07 |
| Land use | Pt | 2.26E+00 | 2.71E+00 | Person-years | 2.76E-06 | 3.30E-06 | Points | 2.19E-07 | 2.62E-07 |
| Water use | $m^3$ depriv. | 2.45E-01 | 2.60E-01 | Person-years | 2.14E-05 | 2.27E-05 | Points | 1.82E-06 | 1.93E-06 |
| Resource use, minerals and metals | kg Sb eq | 2.96E-07 | 6.11E-07 | Person-years | 4.65E-06 | 9.61E-06 | Points | 3.51E-07 | 7.26E-07 |
| Resource use, fossils | MJ | 9.54E-01 | 1.27E+00 | Person-years | 1.47E-05 | 1.95E-05 | Points | 1.22E-06 | 1.62E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **9.97E-06** | **1.22E-05** |

Table 55 - Characterised, normalised and weighted results including the single score per use for swimwear (RP9)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 1.76E-01 | 2.00E-01 | Person-years | 2.34E-05 | 2.64E-05 | Points | 4.92E-06 | 5.56E-06 |
| Climate change - Fossil | kg $CO_2$ eq | 1.72E-01 | 1.94E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 4.32E-03 | 4.79E-03 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 2.36E-04 | 3.14E-04 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 8.08E-10 | 1.11E-09 | Person-years | 1.54E-08 | 2.13E-08 | Points | 9.74E-10 | 1.34E-09 |
| Human toxicity, cancer | CTUh | 2.48E-10 | 2.91E-10 | Person-years | 1.44E-05 | 1.69E-05 | Points | 3.07E-07 | 3.60E-07 |
| Human toxicity, non-cancer | CTUh | 1.15E-09 | 1.62E-09 | Person-years | 8.90E-06 | 1.26E-05 | Points | 1.64E-07 | 2.32E-07 |
| Particulate matter | disease inc. | 2.62E-08 | 2.86E-08 | Person-years | 4.40E-05 | 4.81E-05 | Points | 3.94E-06 | 4.31E-06 |
| Ionising radiation | kBq U-235 eq | 9.58E-03 | 1.39E-02 | Person-years | 2.27E-06 | 3.30E-06 | Points | 1.14E-07 | 1.66E-07 |
| Photochemical ozone formation | kg NMVOC eq | 6.33E-04 | 7.24E-04 | Person-years | 1.55E-05 | 1.77E-05 | Points | 7.40E-07 | 8.47E-07 |
| Acidification | mol $H^+$ eq | 1.15E-03 | 1.31E-03 | Person-years | 2.06E-05 | 2.36E-05 | Points | 1.28E-06 | 1.46E-06 |
| Eutrophication, terrestrial | mol N eq | 2.48E-03 | 2.97E-03 | Person-years | 1.41E-05 | 1.68E-05 | Points | 5.22E-07 | 6.24E-07 |
| Eutrophication, freshwater | kg P eq | 5.44E-06 | 8.14E-06 | Person-years | 3.38E-06 | 5.07E-06 | Points | 9.47E-08 | 1.42E-07 |
| Eutrophication, marine | kg N eq | 2.87E-04 | 3.85E-04 | Person-years | 1.47E-05 | 1.97E-05 | Points | 4.34E-07 | 5.83E-07 |
| Ecotoxicity, freshwater | CTUe | 1.59E+00 | 2.03E+00 | Person-years | 2.80E-05 | 3.59E-05 | Points | 5.37E-07 | 6.89E-07 |
| Land use | Pt | 5.69E-01 | 1.25E+00 | Person-years | 6.94E-07 | 1.53E-06 | Points | 5.51E-08 | 1.22E-07 |
| Water use | $m^3$ depriv. | 9.32E-02 | 1.27E-01 | Person-years | 8.13E-06 | 1.11E-05 | Points | 6.92E-07 | 9.44E-07 |
| Resource use, minerals and metals | kg Sb eq | 1.72E-06 | 1.85E-06 | Person-years | 2.70E-05 | 2.91E-05 | Points | 2.04E-06 | 2.20E-06 |
| Resource use, fossils | MJ | 2.70E+00 | 3.08E+00 | Person-years | 4.16E-05 | 4.73E-05 | Points | 3.46E-06 | 3.94E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **1.93E-05** | **2.22E-05** |

Table 56 - Characterised, normalised and weighted results including the single score per use for apparel accessories (RP10)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 1.31E-01 | 1.32E-01 | Person-years | 1.73E-05 | 1.75E-05 | Points | 3.65E-06 | 3.68E-06 |
| Climate change - Fossil | kg $CO_2$ eq | 9.07E-02 | 9.20E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 2.64E-02 | 2.64E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 1.37E-02 | 1.38E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 1.36E-09 | 1.66E-09 | Person-years | 2.60E-08 | 3.17E-08 | Points | 1.64E-09 | 2.00E-09 |
| Human toxicity, cancer | CTUh | 1.11E-10 | 1.13E-10 | Person-years | 6.43E-06 | 6.58E-06 | Points | 1.37E-07 | 1.40E-07 |
| Human toxicity, non-cancer | CTUh | 2.15E-09 | 2.17E-09 | Person-years | 1.67E-05 | 1.69E-05 | Points | 3.08E-07 | 3.11E-07 |
| Particulate matter | disease inc. | 2.53E-08 | 2.54E-08 | Person-years | 4.24E-05 | 4.26E-05 | Points | 3.80E-06 | 3.82E-06 |
| Ionising radiation | kBq U-235 eq | 3.18E-03 | 3.50E-03 | Person-years | 7.53E-07 | 8.30E-07 | Points | 3.77E-08 | 4.16E-08 |
| Photochemical ozone formation | kg NMVOC eq | 3.82E-04 | 3.86E-04 | Person-years | 9.35E-06 | 9.45E-06 | Points | 4.47E-07 | 4.51E-07 |
| Acidification | mol $H^+$ eq | 2.51E-03 | 2.51E-03 | Person-years | 4.51E-05 | 4.52E-05 | Points | 2.80E-06 | 2.80E-06 |
| Eutrophication, terrestrial | mol N eq | 9.36E-03 | 9.38E-03 | Person-years | 5.30E-05 | 5.31E-05 | Points | 1.97E-06 | 1.97E-06 |
| Eutrophication, freshwater | kg P eq | 2.18E-05 | 2.19E-05 | Person-years | 1.35E-05 | 1.36E-05 | Points | 3.79E-07 | 3.81E-07 |
| Eutrophication, marine | kg N eq | 1.17E-03 | 1.18E-03 | Person-years | 6.00E-05 | 6.02E-05 | Points | 1.78E-06 | 1.78E-06 |
| Ecotoxicity, freshwater | CTUe | 6.88E+00 | 6.90E+00 | Person-years | 1.21E-04 | 1.22E-04 | Points | 2.33E-06 | 2.34E-06 |
| Land use | Pt | 9.96E+00 | 9.99E+00 | Person-years | 1.22E-05 | 1.22E-05 | Points | 9.65E-07 | 9.68E-07 |
| Water use | $m^3$ depriv. | 2.44E-01 | 2.45E-01 | Person-years | 2.13E-05 | 2.14E-05 | Points | 1.81E-06 | 1.82E-06 |
| Resource use, minerals and metals | kg Sb eq | 4.73E-07 | 4.89E-07 | Person-years | 7.44E-06 | 7.69E-06 | Points | 5.62E-07 | 5.81E-07 |
| Resource use, fossils | MJ | 9.89E-01 | 1.01E+00 | Person-years | 1.52E-05 | 1.55E-05 | Points | 1.27E-06 | 1.29E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **2.22E-05** | **2.24E-05** |

Table 57 - Characterised, normalised and weighted results including the single score per use for open-toed shoes (RP11)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 3.06E-01 | 3.06E-01 | Person-years | 4.05E-05 | 4.05E-05 | Points | 8.53E-06 | 8.54E-06 |
| Climate change - Fossil | kg $CO_2$ eq | 2.60E-01 | 2.61E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 3.46E-02 | 3.46E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 1.10E-02 | 1.11E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 8.98E-09 | 8.98E-09 | Person-years | 1.71E-07 | 1.72E-07 | Points | 1.08E-08 | 1.08E-08 |
| Human toxicity, cancer | CTUh | 6.15E-10 | 6.16E-10 | Person-years | 3.57E-05 | 3.57E-05 | Points | 7.60E-07 | 7.61E-07 |
| Human toxicity, non-cancer | CTUh | 1.35E-08 | 1.35E-08 | Person-years | 1.05E-04 | 1.05E-04 | Points | 1.93E-06 | 1.93E-06 |
| Particulate matter | disease inc. | 4.70E-08 | 4.70E-08 | Person-years | 7.89E-05 | 7.90E-05 | Points | 7.07E-06 | 7.08E-06 |
| Ionising radiation | kBq U-235 eq | 9.85E-03 | 9.90E-03 | Person-years | 2.33E-06 | 2.35E-06 | Points | 1.17E-07 | 1.18E-07 |
| Photochemical ozone formation | kg NMVOC eq | 1.50E-03 | 1.51E-03 | Person-years | 3.68E-05 | 3.68E-05 | Points | 1.76E-06 | 1.76E-06 |
| Acidification | mol $H^+$ eq | 3.82E-03 | 3.83E-03 | Person-years | 6.88E-05 | 6.89E-05 | Points | 4.27E-06 | 4.27E-06 |
| Eutrophication, terrestrial | mol N eq | 1.40E-02 | 1.40E-02 | Person-years | 7.94E-05 | 7.94E-05 | Points | 2.94E-06 | 2.95E-06 |
| Eutrophication, freshwater | kg P eq | 2.10E-05 | 2.11E-05 | Person-years | 1.31E-05 | 1.31E-05 | Points | 3.67E-07 | 3.68E-07 |
| Eutrophication, marine | kg N eq | 1.40E-03 | 1.40E-03 | Person-years | 7.15E-05 | 7.16E-05 | Points | 2.12E-06 | 2.12E-06 |
| Ecotoxicity, freshwater | CTUe | 1.04E+01 | 1.04E+01 | Person-years | 1.83E-04 | 1.83E-04 | Points | 3.50E-06 | 3.51E-06 |
| Land use | Pt | 1.52E+01 | 1.52E+01 | Person-years | 1.86E-05 | 1.86E-05 | Points | 1.47E-06 | 1.48E-06 |
| Water use | $m^3$ depriv. | 1.70E-01 | 1.71E-01 | Person-years | 1.48E-05 | 1.49E-05 | Points | 1.26E-06 | 1.27E-06 |
| Resource use, minerals and metals | kg Sb eq | 1.99E-06 | 2.00E-06 | Person-years | 3.13E-05 | 3.15E-05 | Points | 2.37E-06 | 2.38E-06 |
| Resource use, fossils | MJ | 3.70E+00 | 3.71E+00 | Person-years | 5.70E-05 | 5.70E-05 | Points | 4.74E-06 | 4.75E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **4.32E-05** | **4.33E-05** |

Table 58 - Characterised, normalised and weighted results including the single score per use for closed-toed shoes (RP12)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 5.41E-01 | 5.42E-01 | Person-years | 7.17E-05 | 7.18E-05 | Points | 1.51E-05 | 1.51E-05 |
| Climate change - Fossil | kg $CO_2$ eq | 4.41E-01 | 4.42E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 6.92E-02 | 6.93E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 3.10E-02 | 3.11E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 8.99E-09 | 9.00E-09 | Person-years | 1.72E-07 | 1.72E-07 | Points | 1.08E-08 | 1.08E-08 |
| Human toxicity, cancer | CTUh | 8.55E-10 | 8.56E-10 | Person-years | 4.96E-05 | 4.96E-05 | Points | 1.06E-06 | 1.06E-06 |
| Human toxicity, non-cancer | CTUh | 1.42E-08 | 1.42E-08 | Person-years | 1.10E-04 | 1.10E-04 | Points | 2.02E-06 | 2.03E-06 |
| Particulate matter | disease inc. | 9.15E-08 | 9.15E-08 | Person-years | 1.54E-04 | 1.54E-04 | Points | 1.38E-05 | 1.38E-05 |
| Ionising radiation | kBq U-235 eq | 1.92E-02 | 1.92E-02 | Person-years | 4.54E-06 | 4.55E-06 | Points | 2.27E-07 | 2.28E-07 |
| Photochemical ozone formation | kg NMVOC eq | 2.06E-03 | 2.06E-03 | Person-years | 5.03E-05 | 5.04E-05 | Points | 2.40E-06 | 2.41E-06 |
| Acidification | mol $H^+$ eq | 7.40E-03 | 7.40E-03 | Person-years | 1.33E-04 | 1.33E-04 | Points | 8.25E-06 | 8.25E-06 |
| Eutrophication, terrestrial | mol N eq | 2.62E-02 | 2.63E-02 | Person-years | 1.48E-04 | 1.49E-04 | Points | 5.51E-06 | 5.51E-06 |
| Eutrophication, freshwater | kg P eq | 5.28E-05 | 5.29E-05 | Person-years | 3.28E-05 | 3.29E-05 | Points | 9.19E-07 | 9.21E-07 |
| Eutrophication, marine | kg N eq | 3.10E-03 | 3.10E-03 | Person-years | 1.58E-04 | 1.59E-04 | Points | 4.69E-06 | 4.69E-06 |
| Ecotoxicity, freshwater | CTUe | 2.20E+01 | 2.21E+01 | Person-years | 3.89E-04 | 3.89E-04 | Points | 7.46E-06 | 7.47E-06 |
| Land use | Pt | 2.80E+01 | 2.80E+01 | Person-years | 3.42E-05 | 3.42E-05 | Points | 2.71E-06 | 2.72E-06 |
| Water use | $m^3$ depriv. | 5.82E-01 | 5.82E-01 | Person-years | 5.07E-05 | 5.08E-05 | Points | 4.32E-06 | 4.32E-06 |
| Resource use, minerals and metals | kg Sb eq | 3.93E-06 | 3.95E-06 | Person-years | 6.18E-05 | 6.20E-05 | Points | 4.67E-06 | 4.68E-06 |
| Resource use, fossils | MJ | 5.85E+00 | 5.87E+00 | Person-years | 9.00E-05 | 9.03E-05 | Points | 7.49E-06 | 7.51E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **8.06E-05** | **8.07E-05** |

Table 59 - Characterised, normalised and weighted results including the single score per use for boots (RP13)

| Impact category | Characterised results | | | Normalised results | | | Weighted results | | |
|---|---|---|---|---|---|---|---|---|---|
| | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts | Units | Excluding use | Total impacts |
| Climate change | kg $CO_2$ eq | 5.46E-01 | 5.47E-01 | Person-years | 7.23E-05 | 7.24E-05 | Points | 1.52E-05 | 1.53E-05 |
| Climate change - Fossil | kg $CO_2$ eq | 4.60E-01 | 4.61E-01 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Biogenic | kg $CO_2$ eq | 6.50E-02 | 6.51E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Climate change - Land use and land use change | kg $CO_2$ eq | 2.07E-02 | 2.08E-02 | Person-years | n/a | n/a | Points | n/a | n/a |
| Ozone depletion | kg CFC-11 eq | 1.98E-08 | 1.98E-08 | Person-years | 3.78E-07 | 3.78E-07 | Points | 2.38E-08 | 2.39E-08 |
| Human toxicity, cancer | CTUh | 1.28E-09 | 1.28E-09 | Person-years | 7.39E-05 | 7.40E-05 | Points | 1.57E-06 | 1.58E-06 |
| Human toxicity, non-cancer | CTUh | 2.43E-08 | 2.43E-08 | Person-years | 1.89E-04 | 1.89E-04 | Points | 3.47E-06 | 3.48E-06 |
| Particulate matter | disease inc. | 8.77E-08 | 8.78E-08 | Person-years | 1.47E-04 | 1.47E-04 | Points | 1.32E-05 | 1.32E-05 |
| Ionising radiation | kBq U-235 eq | 1.96E-02 | 1.97E-02 | Person-years | 4.64E-06 | 4.66E-06 | Points | 2.33E-07 | 2.34E-07 |
| Photochemical ozone formation | kg NMVOC eq | 2.52E-03 | 2.52E-03 | Person-years | 6.16E-05 | 6.17E-05 | Points | 2.95E-06 | 2.95E-06 |
| Acidification | mol $H^+$ eq | 7.16E-03 | 7.16E-03 | Person-years | 1.29E-04 | 1.29E-04 | Points | 7.99E-06 | 7.99E-06 |
| Eutrophication, terrestrial | mol N eq | 2.62E-02 | 2.62E-02 | Person-years | 1.48E-04 | 1.48E-04 | Points | 5.50E-06 | 5.50E-06 |
| Eutrophication, freshwater | kg P eq | 4.17E-05 | 4.18E-05 | Person-years | 2.59E-05 | 2.60E-05 | Points | 7.26E-07 | 7.29E-07 |
| Eutrophication, marine | kg N eq | 2.60E-03 | 2.60E-03 | Person-years | 1.33E-04 | 1.33E-04 | Points | 3.93E-06 | 3.94E-06 |
| Ecotoxicity, freshwater | CTUe | 1.95E+01 | 1.95E+01 | Person-years | 3.44E-04 | 3.44E-04 | Points | 6.61E-06 | 6.61E-06 |
| Land use | Pt | 2.52E+01 | 2.52E+01 | Person-years | 3.07E-05 | 3.07E-05 | Points | 2.44E-06 | 2.44E-06 |
| Water use | $m^3$ depriv. | 3.57E-01 | 3.58E-01 | Person-years | 3.12E-05 | 3.12E-05 | Points | 2.65E-06 | 2.66E-06 |
| Resource use, minerals and metals | kg Sb eq | 4.93E-06 | 4.95E-06 | Person-years | 7.75E-05 | 7.77E-05 | Points | 5.85E-06 | 5.87E-06 |
| Resource use, fossils | MJ | 6.30E+00 | 6.32E+00 | Person-years | 9.69E-05 | 9.72E-05 | Points | 8.07E-06 | 8.09E-06 |
| Single overall score | Pt | **n/a** | **n/a** | Person-years | **n/a** | **n/a** | Points | **8.04E-05** | **8.05E-05** |

## 7.2 PEF profile

The user of the PEFCR 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 (as a table);
- normalised results in absolute values, for all impact categories (as a table);
- weighted result in absolute values, for all impact categories (as a table);
- the aggregated single overall score in absolute values. This score shall be communicated together with an indication of the IDM and RM methodology used to arrive at said score.

Together with the PEF report, the user of the PEFCR shall develop an aggregated EF compliant dataset of its product in scope. This dataset shall be made available to the European Commission. The disaggregated version may remain confidential.

## 7.3 Classes of performance

Given the limitations of this PEFCR, the TS has decided not to create classes of performance for PEF study results.

## 7.4 Communication of results

The EF methodology, including the approach for calculating the single-score, is currently being reviewed with the aim to address additional environmental considerations on biodiversity and fibre shredding, which are not fully reflected in the current single-score. Because of that,

- **this PEFCR does not allow the use of single score results for business to consumer (B2C) communications** based on PEF studies. This includes single-score **comparisons with the benchmarks** provided in Section 7.1. Only

characterized results for at least the four most relevant indicators shall be communicated, as well as relevant additional information.

- The use of a single score to facilitate B2C communication will be considered in the next update of the PEFCR, which will take place when the EF methods have been revised and adopted by the European Commission
- If EU policies implementing the PEF method or substantiating environmental claims define specific requirements as regards verification, validation and reporting of PEF studies, and communication vehicles, then these requirements shall prevail.

# 8 Verification

The TS recognizes that currently, there are several actors developing or enhancing their tools for the environmental footprinting of products according to the rules documented in this PEFCR. Calculation tools can significantly reduce the costs involved in calculating as well as verifying PEF results. It is, however, important to guarantee that tools claiming compliance with this PEFCR meet a list of requirements. Inspired from other PEFCRs[55], the TS therefore decided to differentiate between two situations for the verification of PEF studies, consisting of several elements:

1) PEF studies not conducted in a tool, described in section 8.1
    - Validation of accuracy and reliance of quantitative information used in the calculation of the study, according to the general verification requirements
2) PEF studies conducted in a pre-verified / PEFCR-compliant tool, described in section 8.2
    - Verification requirements for the initial verification of the tool (pre-verification)
    - further requirements for the recurring verification of the tool
    - additional verification requirements for PEF studies conducted in a pre-verified tool, validating the accuracy and reliance of quantitative information used in the calculation of the study, according to the general verification requirements

Besides the general minimum requirements for verifiers as defined in Section 8 in Annex I of the PEF Method, it is recommended that the “Knowledge of the specific sector” criteria of verifiers is equal to 2 points or higher, which equals between 3 and 6 years of experience. This requirement for verifiers is recommended for the verification of PEF studies not conducted in a tool, the initial and recurring verification of a tool as well as the verification of PEF studies conducted in a pre-verified tool.

[55] Product Environmental Footprint Category Rules for Synthetic Turf Sports & Landscape Surfaces (V01 2024) & Product Environmental Footprint Category Rules for Cut flowers and Potted plants (final version 2024)

If asked by the verifier(s), pictures of the product under study or access to the physical product shall be provided for the verification of the PEF study.

## 8.1 General verification requirements for PEF studies not conducted in a tool

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 9 of the PEF method, including Part A of its Annex and the requirements listed below.

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

In case policies implementing the PEF method define specific requirements regarding verification and validation of PEF studies, reports and communication vehicles, the requirements in said policies shall prevail.

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:

1. 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 impact categories 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;
2. The cut-off applied (if any) fulfils the requirements of this PEFCR and the PEF method;
3. All the newly created datasets shall be checked on their EF compliance (for the meaning of EF compliant datasets refer http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml). All their underlying data (elementary flows, activity data and sub processes) shall be validated;

4. The aggregated EF compliant dataset of the product in scope (meaning, the EF study) is made available to the European Commission.
5. At least 100% of the “mandatory” and 70% of the “mandatory, if available” data (by number of data points) shall be verified.
    - The verifier shall verify that reasonable effort was done to investigate in data points marked as “mandatory, if available” in this PEFCR: the organization conducting the PEF study shall provide to the verifiers a list of the data points together with the PEF study indicating
        - whether the data was obtained or not,
        - which hotspots of the study are impacted by the data point,
        - a description of why a data point was not available and – on request –
        - a summary of the efforts made to collect the data with a respective proof
6. For at least 70% of the most relevant processes (by number) in situation 2 option 2 of the DNM, 70% of the underlying data shall be validated. The 70% of data shall include all energy and transport sub-processes for processes in situation 2 option 2;
7. For at least 60% of the most relevant processes (by number) in situation 3 of the DNM, 60% of the underlying data shall be validated;
8. For at least 50% of the other processes (by number) in situation 1, 2 and 3 of the DNM, 50% of the underlying data shall be validated.

In particular, verifier(s) shall verify if the DQR of the process satisfies the minimum DQR as specified in the DNM for the selected processes.

These data checks shall include, but should not be limited to, the activity data used, the selection of secondary sub-processes, the selection of the direct elementary flows and the CFF parameters. For example, if there are 5 processes and each one of them includes 5 activity data, 5 secondary datasets and 10 CFF parameters, then the verifier(s) has to check at least 4 out of 5 processes (70%) and, for each process, (s)he shall check at least 4 activity data (70% of the total amount of activity data), 4 secondary datasets (70% of the total amount of secondary datasets), and 7 CFF parameters (70% of the total amount of CFF parameters), i.e. the 70% of each of data that could be subject to a check.

The verification of the PEF report shall be carried out by randomly checking enough information to provide reasonable assurance that the PEF report fulfils all the conditions listed in Section 8 of the PEF method, including part A of this Annex.

### 8.1.1 Further verification requirements on IDM and RM

If a product-specific IDM has been evaluated in the PEF study, the verifier(s) shall verify specifically:

- the conditions of the durability testing of the product – i.e., that the tests have been conducted in an ISO-accredited lab and the testing norms have been followed;
- the segmentation of the product outlined in section 3.3.3.1 reflects the product under study;
- that justifications for tests deemed “not applicable”, “not possible” or “not conducted” are provided;
- functionality tests (if applicable) are included as described in section 3.3.3.2;
- in case of the use of alternative tests or conducting ISO/EN tests under different conditions, that the testing equivalence protocol outlined in Part IV of ANNEX V – Detailed requirements regarding intrinsic durability has been followed
- that the calculation of the IDM is according to the rules in section 3.3.3.3

Furthermore, it shall be verified that the calculation of the RM is according to the rules outlined in section 3.3.4.

## 8.2 Verification requirements for PEF studies conducted in a pre-verified tool

### 8.2.1 Initial pre-verification of the tool

The aim of the pre-verification of a tool is to check the compliance with this PEFCR. A tool is verified based on the tool itself as well as the first PEF report and the first PEF verification report based on the tool.

The tool owner shall arrange for the verification of the tool by a third party. The virtual representative products, i.e. recalculating the RP models in the tool, shall be used for the first verification. The tool shall use a valid version of the EF database.
As stated in the RP study report, durability aspects aren't considered in the PEF-RP study as it analyses average products with an average durability. Therefore, additional verification of the IDM and RM calculation model in the tool shall be conducted separately. The calibration sheet provided in ANNEX XI – Calibration sheet for the pre-verification of the IDM calculation module in tools can be used as a basis for the calibration of the IDM calculation module in the tool.
The tool verification shall be documented by the verifier(s) in a tool verification report and shall be made available to tool users. The verification of the first PEF study developed by the tool shall be part of the pre-verified tool verification.

#### 8.2.2 Recurring verification of the tool

Given the complexity of the model and to ensure the robustness of the tool, a randomized verification of 5 PEF studies per semester (i.e. 10 PEF studies per year) conducted through the tool shall be ensured.
Any changes to the tool beyond the variation of user-defined input parameters (e.g., including an updated version of the EF database) shall result in a new version of the tool (so, tool versioning is required). All changes that may affect numeric results of the PEF calculation require a re-verification of the tool, which may be limited to the modules within the tool that were affected by the modification. Only verified versions of the tool shall be used for PEF studies.

#### 8.2.3 Further verification requirements for the pre-verification of the tool and PEF studies conducted in the tool

In case policies implementing the PEF method define specific requirements regarding verification and validation of PEF studies, reports and communication vehicles, the requirements in said policies shall prevail.

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 (based on the verification requirements defined in section 8.1):

Table 60 – Verification requirements for PEF studies conducted in a tool

| Bullet Nr. | Pre-verification of the tool | Further requirements for conducting PEF studies in a pre-verified tool |
|---|---|---|
| **1** | 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 impact categories 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. | - |
| **2** | - | The cut-off applied (if any) fulfils the requirements of this PEFCR and the PEF method; |
| **3** | All secondary datasets included by default in the tool shall be checked against the data requirements (sections 4.6.3 and 4.6.5 of Annex I of the PEF Method) | All other datasets, i.e. secondary datasets not originally included in the tool and newly created datasets, shall be checked against the data requirements (sections 4.6.3 and 4.6.5 of Annex I of the PEF Method) |
| **4** | - | The aggregated EF compliant dataset of the product in scope (meaning, the EF study) is made available to the European Commission. |
| **5** | The tool shall require the user to populate fields related to the list of mandatory data required in this PEFCR. | At least, 100% of the "mandatory" and 70% of the "mandatory, if available" data (by number of data points) shall be validated. The verifier shall verify that reasonable effort was done to investigate in data points marked as "mandatory, if available" in this PEFCR: the organization conducting the PEF study shall provide to the verifiers a list of the data points together with the PEF study indicating<br>- whether the data was obtained or not,<br>- which hotspots of the study are impacted by the data point,<br>- a description of why a data point was not available and – on request –<br>- a summary of the efforts made to collect the data with a respective proof |
| **6** | - | For at least 70% of the most relevant processes (by number) in situation 2 option 2 of the DNM, 70% of the underlying data shall be validated. The 70% of data shall include all |

| | | |
|---|---|---|
| | | energy and transport sub-processes for processes in situation 2 option 2; |
| **7** | - | For at least 60% of the most relevant processes (by number) in situation 3 of the DNM, 60% of the underlying data shall be validated |
| **8** | - | For at least 50% of the other processes (by number) in situation 1, 2 and 3 of the DNM, 50% of the underlying data shall be validated. |

Besides the verification requirements outlined in Table 60, for PEF studies conducted in a pre-verified tool the following verification requirements apply:

In particular, verifier(s) shall verify if the DQR of the process satisfies the minimum DQR as specified in the DNM for the selected processes.

These data checks shall include, but should not be limited to, the activity data used, the selection of secondary sub-processes, the selection of the direct elementary flows and the CFF parameters. For example, if there are 5 processes and each one of them includes 5 activity data, 5 secondary datasets and 10 CFF parameters, then the verifier(s) has to check at least 4 out of 5 processes (70%) and, for each process, (s)he shall check at least 4 activity data (70% of the total amount of activity data), 4 secondary datasets (70% of the total amount of secondary datasets), and 7 CFF parameters (70% of the total amount of CFF parameters), i.e. the 70% of each of data that could be subject to a check.

The verification of the PEF report shall be carried out by randomly checking enough information to provide reasonable assurance that the PEF report fulfils all the conditions listed in Section 8 of the PEF method, including part A of this Annex.

In addition to the above verification requirements, further requirements on the verification of the IDM and RM shall be verified according to section 8.1.1.

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# ANNEX I – 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. The normalisation and weighting factors in Table A.I 1 shall be applied (EF reference package 3.1, 2022).

Table A.I 1 - EF 3.1 normalisation and weighting factors

| Impact categories | Normalisation Factor Unit | Normalisation Factor | Weighting Factor [%] |
|---|---|---|---|
| **Acidification** | mol H+ eq./person | 5.56E+01 | 6.20% |
| **Climate change** | kg $CO_2$ eq./person | 7.55E+03 | 21.06% |
| **Ecotoxicity, freshwater** | CTUe/person | 5.67E+04 | 1.92% |
| **EF-particulate matter** | disease incidences/person | 5.95E-04 | 8.96% |
| **Eutrophication, freshwater** | kg P eq./person | 1.61E+00 | 2.80% |
| **Eutrophication, marine** | kg N eq./person | 1.95E+01 | 2.96% |
| **Eutrophication, terrestrial** | mol N eq./person | 1.77E+02 | 3.71% |
| **Human toxicity, cancer** | CTUh/person | 1.73E-05 | 2.13% |
| **Human toxicity, non-cancer** | CTUh/person | 1.29E-04 | 1.84% |
| **Ionising radiation** | kBq U-235 eq./person | 4.22E+03 | 5.01% |
| **Land use*** | pt/person | 8.19E+05 | 7.94% |
| **Ozone depletion** | kg CFC-11 eq./person | 5.23E-02 | 6.31% |
| **Photochemical ozone formation** | kg NMVOC eq./person | 4.09E+01 | 4.78% |
| **Resource depletion, fossils** | MJ/person | 6.50E+04 | 8.32% |
| **Resource depletion, minerals and metals** | kg Sb eq./person | 6.36E-02 | 7.55% |
| **Water use*** | $m^3$ water eq of deprived water/person | 1.15E+04 | 8.51% |

# ANNEX II – PEF study template

Annex II is provided as a separate document.

# ANNEX III – Review reports of the PEFCR and PEF-RP(s)

Annex III is provided as a separate document.

# ANNEX IV – Designing the representative product model

Given the large number of products considered, significant reflection within the TS was required to determine the product sub-categories. The following high-level principles for decision making were used:

1. How similar are the product functions?
    - For example, no one would choose a sneaker instead of a hat.
2. Which products could provide the same function but may be selected over another for a specific reason?
    - One would choose to wear leggings to go running and not dress pants.
    - To go to the office, one could choose to wear jeans or dress pants.
3. Can each product fit only within one sub-category?
    - If we had sub-categories for fashion and boots, where would a tall leather dress boot fit?
4. How many products are included in one sub-category?
    - If one sub-category accounts for a significant market share, sub-division may be justified.
5. Would the hotspots be similar for products within the sub-category?
    - The aim would be to avoid having one product at one end of the scale within a sub-category.
    - However, this could lead to splitting the categories by use (e.g., casual, fashion, sports), size or material which increases the workload exponentially.

After this exercise and discussions, the apparel and footwear PEFCR were classified into 13 product sub-categories, defined as products that can fulfil equivalent functions and applications as defined by the PEF method.

Due to the relative market sales of accessories compared to other apparel and footwear products, the TS could not justify separating accessories into unique product sub-categories as this would significantly increase the workload.

Products included in each sub-category and a description of each RP is included in Table 4. For the definition of RP BOMs, each sub-category is divided into two to five

products matching the categorization of market data available from EURATEX for the identification of product representativeness on the European market as described below.

**Bill of materials (BOM)**

For each sub-category, key products were identified based on market shares of apparel and footwear products sold in Europe (EURATEX data, 2018).

The market splits used within this study are representative of apparel and footwear products produced in and imported to Europe, minus products that were exported from Europe, and were calculated based on product volumes. The main product groups identified per sub-category based on the market shares data from EURATEX are shown in Table A.IV 1 below.

Table A.IV 1 - Market sales share of top products per sub-category

| No. | Sub-category/ representative product | Products included | Market shares |
|---|---|---|---|
| 1 | T-shirts | T-shirts | 99.6% |
| | | Collared short-sleeved shirts | 0.4% |
| 2 | Shirts and blouses | Long-sleeved shirts | 75.8% |
| | | Blouses | 24.2% |
| 3 | Sweaters and midlayers | Jerseys and pullovers | 50.9% |
| | | Sweatshirts | 17.1% |
| | | Cardigans | 22.3% |
| | | Waistcoats | 9.7% |
| 4 | Jackets and coats | Blazers/suit jackets | 31.4% |
| | | Rain jackets | 11.0% |
| | | Overcoats | 7.3% |
| | | Outdoor winter jackets | 38.0% |
| | | Light short jackets | 12.3% |
| 5 | Pants and shorts | Pants | 80.6% |
| | | Shorts | 19.4% |
| 6 | Dresses, skirts and jumpsuits | Dresses | 60.0% |
| | | One-piece suits | 14.1% |
| | | Skirts | 14.4% |
| | | Robes | 11.4% |
| 7 | Leggings, stockings, tights and socks | Pantyhose and tights | 28.8% |
| | | Hosiery | 49.1% |
| | | Socks | 22.1% |
| 8 | Underwear | Underwear | 81.2% |
| | | Bras | 18.1% |
| | | Body-shaping suits | 0.8% |
| 9 | Swimwear | Women’s swimwear | 76.6% |

| No. | Sub-category/ representative product | Products included | Market shares |
|---|---|---|---|
| | | Men's swimwear | 23.4% |
| 10 | Apparel accessories | Hats | 42.2% |
| | | Scarves and ties | 2.1% |
| | | Belts | 9.9% |
| | | Gloves and mittens | 45.9% |
| 11 | Open-toed shoes | Casual /fashion sandals | 57.0% |
| | | Flip-flops | 15.0% |
| | | Open-toed slippers | 19.8% |
| | | Athletic sandals | 8.2% |
| 12 | Closed-toed shoes | Casual /fashion shoes | 70.0% |
| | | Slippers | 23.5% |
| | | Protective shoes | 1.0% |
| | | Athletic shoes | 5.5% |
| 13 | Boots | Casual /fashion boots | 51.4% |
| | | Protective boots | 16.4% |
| | | Polymer boots | 14.0% |
| | | Athletic boots | 18.2% |

Totals per RP may not reach 100% due to rounding.

The shares of each material in the average final product weight (g/product for apparel and g/pair for footwear) per functional unit are given in Table A.IV 2 for apparel (representative products 1-10) and Table A.IV 3 for the footwear product sub-categories (representative products 11-13).

Primary data at product level were collected from TS members for each product sub-category. TS members provided raw material inputs for key products, based on either highest volume products or average product data per product sold in Europe, using average sizes. Data collected from TS members were weighted based on their representativeness of an average product sold in the European market using market sales data provided by EURATEX (2018), as well as the average fibre data from the TE Market Report on preferred fibre and materials (2020a).

Table A.IV 2 - Bill of materials for the apparel representative products with the share (%) of each material based on the average product weight[56]

| List of materials | RP1 T-shirts | RP2 Shirts & blouses | RP3 Sweaters & midlayers | RP4 Jackets & coats | RP5 Pants & shorts | RP6 Dresses, skirts and jumpsuits | RP7 Leggings, stockings, tights and socks | RP8 Underwear | RP9 Swimwear | RP10 Apparel accessories |
|---|---|---|---|---|---|---|---|---|---|---|
| **Average weight [g/product]** | **170** | **250** | **500** | **950** | **450** | **300** | **130** | **80** | **120** | **110** |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |
| Acrylic | - | - | 5% | 11% | - | - | 7% | - | - | 16% |
| Cashmere and camel hair | - | - | 4% | 0.9% | - | - | - | - | - | - |
| Cotton[57] | 70% | 55% | 34% | 15% | 47% | 54% | 22% | 70.5% | - | 15% |
| Duck down | - | - | - | 0.9% | - | - | - | - | - | - |
| Elastane | - | - | - | - | 4% | - | 9% | 7% | 9% | - |
| Mink fur | - | - | - | 0.2% | - | - | - | - | - | - |
| Fox fur | - | - | - | 0.05% | - | - | - | - | - | - |
| Rabbit fur | - | - | - | 0.01% | - | - | - | - | - | - |
| Leather, bovine | - | - | - | 0.2% | 0.2% | - | - | - | - | 1.4% |
| Leather, calf | - | - | - | 0.1% | 0.1% | - | - | - | - | 1.4% |
| Leather, ovine | - | - | - | 0.4% | 0.6% | - | - | - | - | 2.1% |
| Leather, caprine | - | - | - | 0.1% | 0.1% | - | - | - | - | 0.8% |
| Leather, other (porcine) | - | - | - | 0.0% | 0.0% | - | - | - | - | 1.3% |
| Linen | - | 5% | - | - | 4% | - | - | - | - | - |
| Polyamide | - | - | 2% | 15% | 7% | 4% | 27% | 10% | 51% | 4% |
| Polyamide recycled | - | - | - | - | - | - | 4% | 2% | - | - |
| Polyester and other synthetics[58] | 21.3% | 23.2% | 21.7% | 35.6% | 30.9% | 24.5% | 18.8% | 5.1% | 37.6% | 30.3% |
| Polyester recycled | 2% | 3% | 4% | 4% | 3% | 2% | 2% | - | 2% | - |

[56] Totals per RP may not reach 100% due to rounding.

[57] Although data from the past years indicate an increased share of organic cotton on the European market (Textile Exchange, 2020b), the actual share of organic cotton in 2019 was 0.93% globally. Because of this very low share, organic cotton is included here in the cotton category.

[58] Other synthetics include aramid, copolyester, elastodiene, elastolefin, EVA, polyethylene, rubber synthetic.

| List of materials | RP1 T-shirts | RP2 Shirts & blouses | RP3 Sweaters & midlayers | RP4 Jackets & coats | RP5 Pants & shorts | RP6 Dresses, skirts and jumpsuits | RP7 Leggings, stockings, tights and socks | RP8 Underwear | RP9 Swimwear | RP10 Apparel accessories |
|---|---|---|---|---|---|---|---|---|---|---|
| PTFE | - | - | - | 1.8% | - | - | - | - | - | - |
| Silk | - | - | - | - | - | - | - | - | - | 1% |
| Viscose/ Modal/ Lyocell[59] | 6% | 13% | 5% | 4% | 2% | 13% | 8% | 5% | - | - |
| Wool | - | - | 24% | 9% | - | 2% | 2% | - | - | 26% |
| Trims[60] | 0.7% | 0.8% | 0.3% | 1.6% | 1.1% | 0.5% | 0.2% | 0.4% | 0.4% | 0.7% |

[59] Because of the very similar production processes of viscose and Modal as well as the overall low share of Lyocell, these materials are grouped in the same category.

[60] The assumed material composition of trims is an equal share of care labels (PES), buttons (PET) and zippers (metal for RP4, RP5 and RP10 and nylon for RP1, RP2, RP3, RP6, RP7, RP8, RP9 as a proxy for other plastic trims).

Table A.IV 3 - Bill of materials for the footwear representative products with the share (%) of each material based on the average product weight[61]

| List of materials | RP11 Open-toed shoes | RP12 Closed-toed shoes | RP13 Boots |
|---|---|---|---|
| **Average weight [g/pair]** | **350** | **900** | **1100** |
| **Total** | **100%** | **100%** | **100%** |
| Wood-based nonwoven | - | - | 2% |
| Cork | 5% | - | - |
| Cotton [62] | - | 3% | - |
| EVA | 28% | 7% | - |
| Leather, cow | 13% | 7% | 12% |
| Leather, calf | 1.7% | 1.4% | 4.9% |
| Leather, sheep | 1.1% | 0.5% | 2.6% |
| Leather, goat | 1.1% | 1.3% | 1.4% |
| Leather, other (proxy: swine) | 0.3% | 0.3% | 0.2% |
| Metal | - | - | 2% |
| Polyamide | - | 3% | 3% |
| Polyester and other synthetics[63] | 3% | 26% | 13% |
| Polyester recycled | - | 3% | 2% |
| Polyurethane | 8% | 6% | 10% |
| PVC | 6% | 6% | 14% |
| Rubber natural | 13% | 8% | 5% |
| Rubber synthetic | 19% | 16% | 11% |
| Thermoplastic polyurethane | - | 3% | 14% |
| Viscose/ Modal[64] | - | 2% | - |
| Wool | - | 4% | - |
| Trims[65] | 1% | 2% | 3% |

The average final product weights presented in Table A.IV 2 and Table A.IV 3 correspond to the weight of the final product after raw materials acquisition and pre-processing, manufacturing and assembly. The sum of all raw material inputs needed per representative product are higher than the final product weight due to losses along the production and value chain. The input amount per functional unit is therefore

[61] Totals per RP may not reach 100% due to rounding.

[62] Although data from the past years indicate an increased share of organic cotton on the European market (Textile Exchange, 2020b), the actual share of organic cotton in 2019 was 0.93% globally. Because of this very low share, organic cotton is included here in the cotton category.

[63] Other synthetics include aramid, copolyester, elastodiene, elastolefin, polyethylene.

[64] Because of the very similar production processes of viscose and modal these materials are grouped in the same category.

[65] The assumed material composition of trims is shoe laces for RP11, an equal share of shoe laces, shoe eyelets (nylon) and shoe eyelets (metal) for RP12 and an equal share of zippers (metal(, shoe laces, shoe eyelets (nylon) and shoe eyelets (metal) for RP13 .

calculated data and the quantities are determined according to residual losses during the production processes (See Section 6.1.2 for details)

# ANNEX V – Detailed requirements regarding intrinsic durability

Annex V is provided as a separate document.

| | |
|---|---|
| Note | This entire section has been revised between PEFCR v1.3 and PEFCR v2.0. The intrinsic durability tests are optional, and though highly recommended, not mandatory. A default quality multiplier of 0.67 shall be used should no intrinsic durability tests be conducted (except for exemptions mentioned in Section 3.3.3.2). |

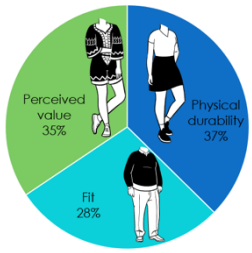
# ANNEX VI – Exploring the extrinsic durability of apparel and footwear products

Duration of Service (DoS), or product lifetime, is a key metric in the Apparel & Footwear PEFCRs (A&F PEFCR) – it is an estimate of the number of times a product is used in its lifetime (DoS), which is used in the functional unit of this PEFCR.

The Holistic Durability Working Group (HDWG) has identified that the consumer primarily determines the DoS, so started out by finding out what made consumers decide that End of Life (EoL) had been reached.

17 separate peer-reviewed consumer studies presented in Table A.VI 2 have helped to identify three major EoL sources:

- Worn out: 37%
- Poor fit: 28%
- Low perceived value (fashion, cheapness, …): 35%




These EoL sources, coming from strong scientific studies, led the HDWG to identify two primary dimensions of apparel and footwear lifetimes:

- Intrinsic dimension: product-specific attributes that contribute to lifetime:
  - Physical durability
  - Design for fit
  - Design for value
- Extrinsic dimension: external attributes that influence the likelihood of a product reaching its potential lifetime (e.g. company/commercial practices)

It is clear that DoS are influenced by many different factors, some of which are dependent on one another. The HDWG focused only on characterising non-physical durability factors as other elements were addressed by other working groups: the Physical durability WG focussed on the physical durability attributes that are part of the intrinsic durability, and the Repairability WG focussed on refining the repairability multiplier.

## Holistic Durability Methodology

The HDWG defined secondary attributes for the Fit and Perceived Value EoL reasons.

Table A.VI 1 - Attributes affecting Duration of Service

| EoL Reason | Dimension | Secondary Attribute | Definition (Presence of …) |
|---|---|---|---|
| Fit | Intrinsic | Extensive fit options for the product. | Number of sizes per SKU offered at point of sale |
| | Intrinsic | Perfect point of sale (POS) fit for the product | Customisable fit or Made to measure service provided at point of sale. |
| | Intrinsic | Inherent adjustability | Design features that contribute to wearing ease, such as pleats and multi-position buttons and fastenings. |
| Perceived Value | Intrinsic | Enduring Style | Absence of product style changes from season to season or year on year. |
| | Extrinsic | Personalisation | Personalisation service (direct consumer participation in design |
| | Intrinsic | Modular Design | Two or more configurations to extend wearing opportunities. |
| | Intrinsic | Reversibility | Product can be worn or used inside out. |
| | Extrinsic | Renewal Rate (R) | Collection renewal frequency |
| | Intrinsic | Price | Retail price prior to discounting. |
| | Intrinsic | Repairability included parts | Spare Parts included with product |
| | Extrinsic | Ease of reuse/resale | Share of second-hand products in a category sold by a brand as a percentage of total sales for that category |
| | Extrinsic | Discounting Rate (D) | Frequency and intensity of discounting |
| | Extrinsic | Product Range size (PR) | Total number of articles of (x product type) (y customer segment) / total volume (customer segment) products |
| | Extrinsic | Repairability Services | Brand provides access to repair services in-house or through a partner. |
| | Extrinsic | Repairability Info | Repair documentation is provided to customer |
| | Intrinsic | Repair Cost ratio | Relative Price of repair vs price of product |
| Physical Durability | Intrinsic | Fabric Performance | Appearance changes (pilling and abrasion) |
| | Intrinsic | Fabric Performance | Colour fastness |
| | Intrinsic | Functional Performance | Persistence of applied functionality through wash and wear |
| | Intrinsic | Garment Integrity Resistance to multiple cleaning cycles | Appearance change |
| | Intrinsic | Garment Integrity Resistance to multiple cleaning cycles | Dimensional stability |

| | | | |
|---|---|---|---|
| | Intrinsic | Garment Integrity Resistance to multiple cleaning cycles | Seam & trim integrity |

Note: This table includes all secondary attributes considered over the tenure of the HDWG. The HDWG developed criteria for the attributes (apart from physical durability and repairability) and tested them according to the below key points:

- The science behind each criterium and how to weigh them within their lifetime multiplier (EoL reason);
- The relevance to the various representative subproduct types;
- The scalability: data collection, calculation, and verification.

## Conclusion and Recommendations

The DoS multipliers are designed to predict the increase or decrease in number of lifetime-uses associated with the presence or absence of intrinsic attributes and extrinsic influences. After considerable debate, the HDWG concluded that the lack of science prevented it from progressing integration of the missing attributes (several intrinsic attributes relating to physical durability and extrinsic attributes relating to repairability being included) into PEFCR v2.0. For DoS multipliers to meaningly predict the number of lifetime-uses they must be:

1. Based on scientific evidence demonstrating a causal link with DoS;
2. Weighted to reflect their relative importance to other attributes and;
3. Scalable, enabling adoption by the broader textile industry.

The lack of science supporting Points 1 and 2, together with difficulties for brands in extracting the required data prevented the HDWG from proposing the needed methodology improvements in the PEFCRs.

In order to overcome the status quo, the HDWG recommends the following solutions to improve and update the PEFCR A&F:

- Add an appendix to PEFCR A&F to:
    - gather public consultation insight on intrinsic & extrinsic attributes;
    - inform next TS of rationale & barriers;
    - provide textile industry insight to improve scalability;

- Engage the fashion ecosystem and the European Commission into conducting deeper scientific research into the causal links and relative importance of intrinsic and extrinsic attributes on the DoS. Especially on below criteria:
    - Intrinsic - Attributes influencing physical durability, fit, and perceived value;
    - Extrinsic - Renewal rate, discount rate; size/width of product range (relative size), ease of reuse/resale.

Table A.VI 2 - Consumer studies into reasons for disposal

| Study | Survey Design | Wear & Tear | Fit | Per-ceived value | Other / un-known |
|---|---|---|---|---|---|
| AC Nielsen (Laitala & Klepp 2020) **(Laitala & Klepp, What affects garment lifespans? International clothing practices based on wardrobe survey in China, Germany, Japan, the UK and the USA., 2020)** | Five countries, 1111 adults 40,456 garments | 44% | 13% | 35% | 9% |
| WRAP **(WRAP, 2017)** | UK 2058 adults, 16,895 garments | 18% | 42% | 33% | 7% |
| Laitala et al 2015 **(Laitala, Boks, & Klepp, Making Clothing Last: A Design Approach for Reducing the environmental impacts, 2015)** | Norway Adults (9 men and 16 women) 396 garments | 50% | 16% | 24% | 10% |
| Klepp 2001 **(Klepp, 2001)** | Norway 24 women Ages 34- 46 329 garments | 31% | 15% | 33% | 21% |
| Collett et al 2013 **(Collett, Cluver, & Chen, 2013)** | 13 female students Ages 18 – 28 | 41% | 38% | 21% | |
| Chun 1987 **(Chun, 1987)** | USA, 89 female students Ages 18 - 30 | 6% | 29% | 56% | 9% |
| Lang et al 2013 **(Lang, Armstrong, & Brannon, 2013)** | USA 555 Adults | 30% | 31% | 39% | |
| Koch & Domina 1997 **(Koch & Domina, The effects of environmental attitude and fashion opinion leadership on textile recycling in the US. J, 21(1), 1-17., 1997) (Koch & Domina, Consumer Textile Recycling as a Means of Solid Waste Reduction., 1999)** | USA 277 students | 29% | 38% | 33% | |
| Koch & Domina 1999 [13] | USA 396 Adults | 21% | 37% | 42% | |
| **Zhang et al, 2020 (Zhang, Wu, Liu, Wu, & Yang, 2020)** | China 507 Adults | 43% | 19% | 22% | 16% |
| Ungeth & Carlsson, 2011 **(Ungerth & Carlsson, 2011)** | Sweden 1014 Adults | 60% | 8% | 21% | 9% |

| Study | Survey Design | Wear & Tear | Fit | Per-ceived value | Other / un-known |
|---|---|---|---|---|---|
| YouGov, 2019 **(Yougov, 2019)** | Italy 992 Adults | 31% | 24% | 20% | 25% |
| YouGov, 2017 **(Yougov, n.d.) (Yougov, n.d.) (Yougov, n.d.) (Yougov, n.d.) (Yougov, n.d.)** | Australia, Philippine, Malasia, Hong Kong & Singapore (12434 Adults) | 39% | 25% | 29% | 7% |
| **Mean** | **Approx. 20,000 adults** | **34.1%** | **25.8%** | **31.4%** | **12.6%** |

# ANNEX VII – Inventory modelling and default datasets

This annex is provided as a separate document and contains a list of:

- Mandatory company-specific data to be collected; and how they're used in modelling ("Data requirements" tab);
- Mandatory default datasets to be used for use phase processes ("Default datasets & DQR" tab);
- Optional default datasets to be used for packaging production, transport and distribution, and end of life processes (e.g. datasets for modelling Ev, E*v, Erec, Ed); ("Default datasets & DQR" tab);
- Optional trims and manufacturing datasets used in the RP-study v2.0 should the user of the PEFCR not have access to product specific data ("Default datasets & DQR" tab);
- Mandatory/optional datasets to be used for wipers production and recycled polyester and polyamide production should the user of the PEFCR not have access to product specific data ("Wipers & recycled datasets" tab);
- Proxies for processes for which no datasets are available or no exact match was found during the supporting studies and PEF-RP study (e.g., exact fibre but not produced in the exact region) ("Data gaps proxies" tab).

# ANNEX VIII – Data collection scenarios and examples of the application of the DNM in the context of this PEFCR

In this annex, 4 fictitious companies A, B, C and D conducting different steps to produce the same t-shirt and deciding to commission the PEF study of the final t-shirt are illustrated. Depending on the relevance of the processes and whether the company conducting the PEF study has access to the primary data or not, the rules of how to apply the DNM (see section 5.4) are described.

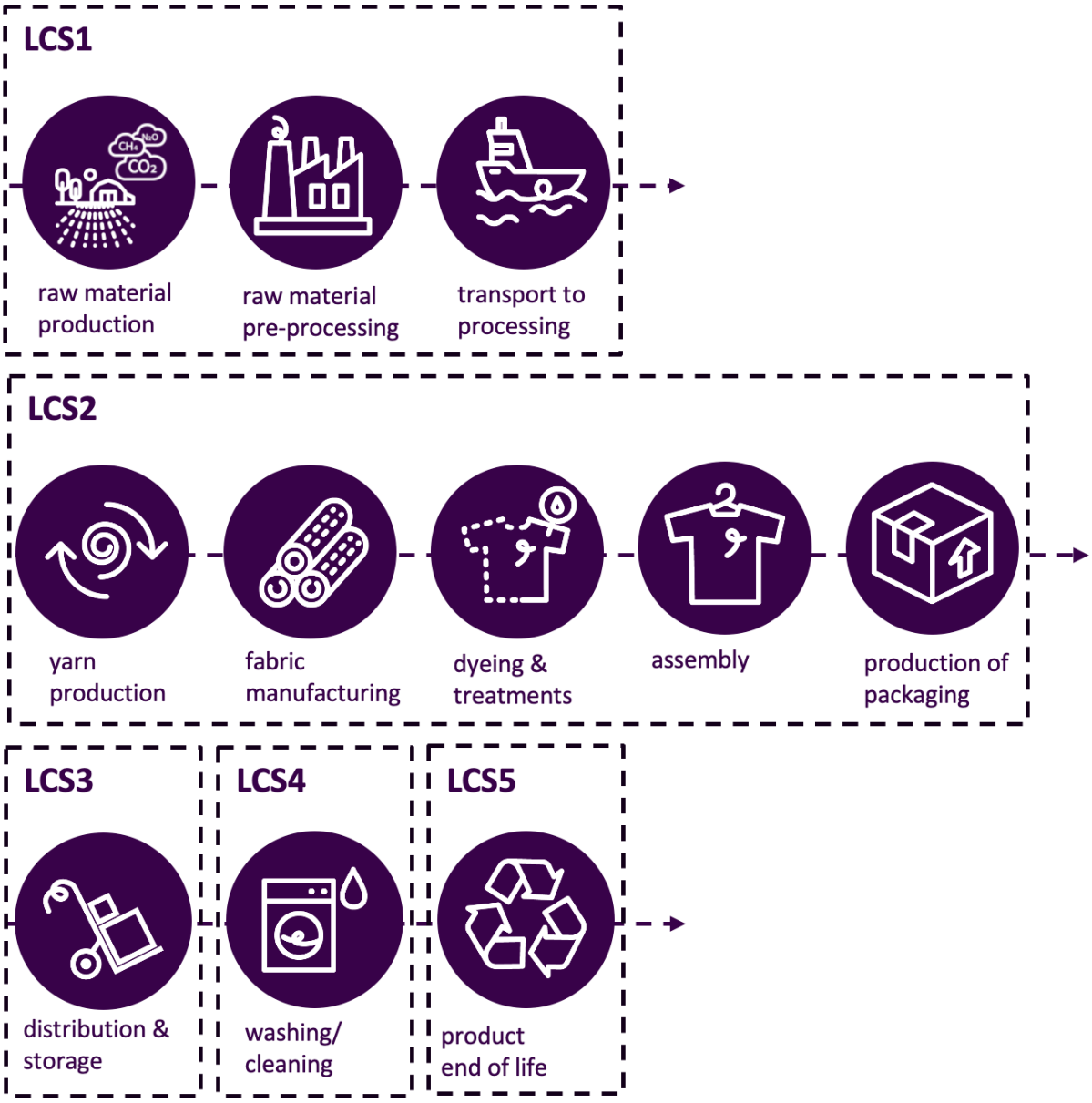



Figure A.VIII 1 - simplified, illustrative steps within the product's life cycle

**Overview of the 4 scenarios:**

**Scenario 1:**

company A, a retailer, buys the t-shirt and has no insights about the supply chain

**Scenario 2:**

company B outsources the production of the t-shirt using cotton from company D (Scenario 4) and has access to the data from company D

**Scenario 3:**

company C manufactures the t-shirt with no visibility on the supply chain

**Scenario 4:**

company D produces cotton in the US

Figure A.VIII 2 - overview of 4 scenarios for the illustration of the application of the DNM

**Common data collection rules for all companies in all 4 scenarios**

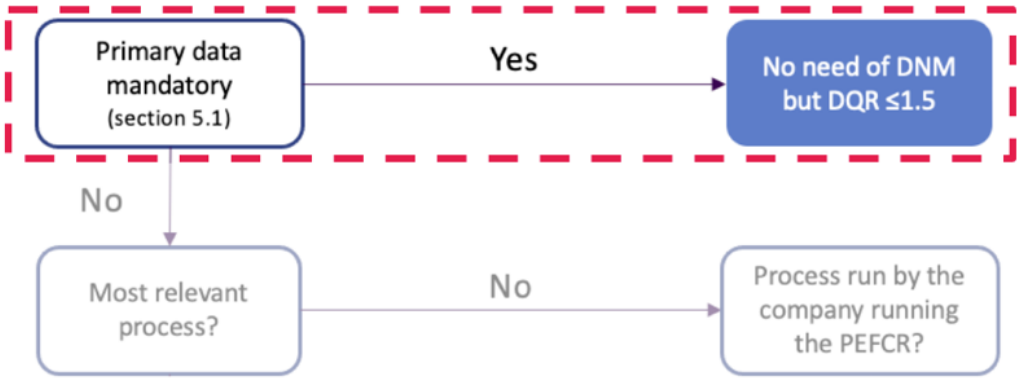



Figure A.VIII 3 - DNM decision tree for "mandatory" data points

For all companies A, B, C & D in all 4 scenarios, the same data collection requirements for «mandatory» data points apply:

- collection of company-specific data
- DQR ≤ 1.5

The «mandatory» data points (see section 5.1) are summarized in Table A.VIII 3.

Table A.VIII 1 - overview on “mandatory” company-specific data

| Life Cycle Stage | Mandatory company-specific data |
|---|---|
| 1 – raw material acquisition & pre-processing | • At least 95% of the product’s Bill Of Materials (BOM) by weight, covering 100% of the main fabrics, lining, padding, and electronic parts and metals<br>• If the BOM isn't available, product weight and reference size<br>• Raw material mass transported |
| 2 - manufacturing | • If the BOM isn’t available, assembly loss rate for the product studied |
| 3 - distribution | • Air cargo distances at company level<br>• Air cargo share of product mass transported for each origin at company level<br>• Product weight (if not collected in LCS1) |
| 4 - use | • Apparel: Product type, if delicate product or sportswear |
| General | • Share (% product) of unsold consumer products at product sub-category or product category (apparel and footwear) level |

Furthermore, for all companies A, B, C & D in all 4 scenarios, the same data collection requirements for «mandatory, if available» data points apply. The «mandatory, if available» data points (see section 5.1) are:

Table A.VIII 2 - overview on “mandatory, if available” company-specific data

| Life Cycle Stage | Mandatory, if available company-specific data |
|---|---|
| 1 – raw material acquisition & pre-processing | • raw materials transport distances, modes, share of raw material mass transported for each transport leg, and utilisation rates for trucks |
| 2 - manufacturing | • manufacturing technologies<br>• other processing loss rates<br>• energy mix of the manufacturing steps for the product studied – exempted for SMEs<br>• intermediate product transport distances, modes, share of semi-finished product mass transported for each origin and utilisation rates for trucks |
| 3 - distribution | • product transport distances, modes, share of product mass transported for each origin and utilisation rates for trucks |

According to section 5.4**, further processes** (beside the mandatory ones) **shall be evaluated according to the DNM –** to determine which data are needed and shall be used within the modelling of the PEF, depending on the level of influence the user of the PEFCR (company) has on the specific process.

**Scenario 1: company A, a retailer, commissions the PEF study of the t-shirt, without running any processes and access to data**

Company A is in situation 3, Options 1 & 2 for all processes related to the life cycle of the t-shirt. It therefore needs to (see DNM):

most relevant processes:

- Use default secondary data set in aggregated form (DQR≤3.0)
- Re-evaluate the DQR criteria within the product specific context

other processes:

- Use default secondary data set in aggregated form (DQR≤4.0)
- Use the default DQR values

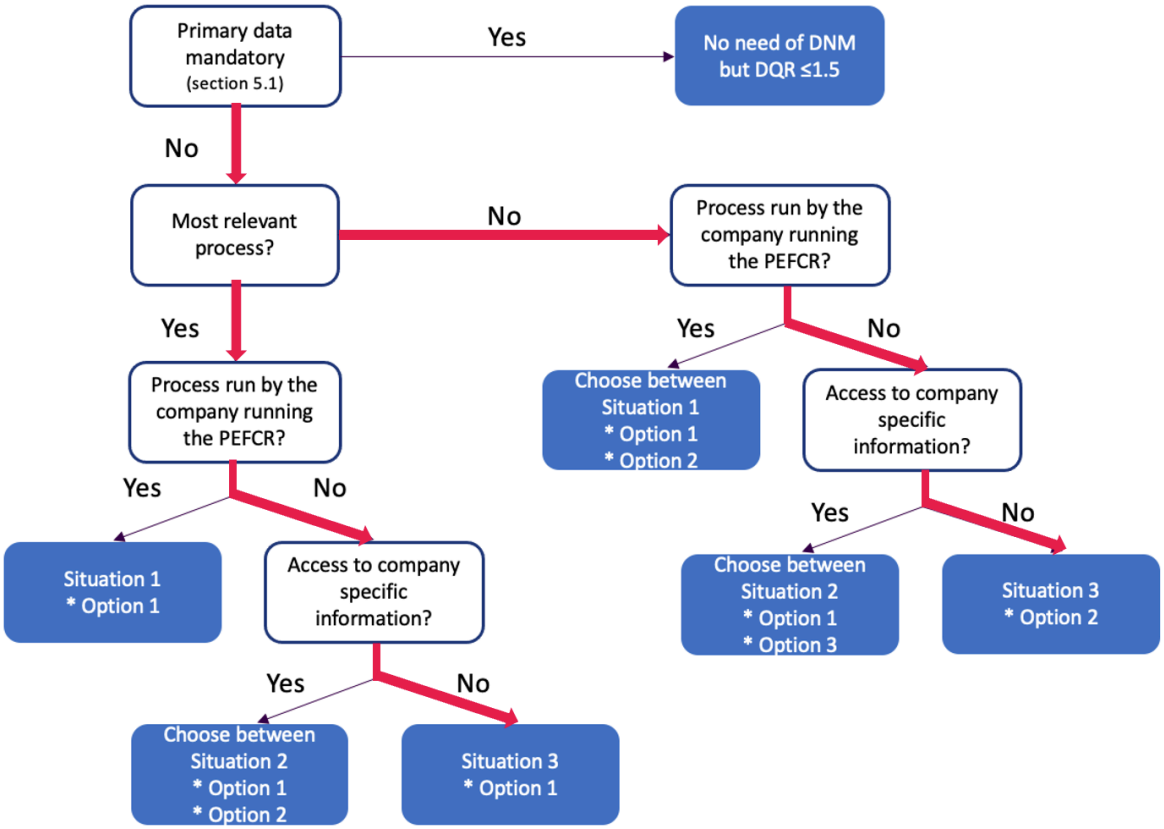



Figure A.VIII 4 - DNM decision tree for Scenario 1 / company A

**Scenario 2: company B commissions the PEF study of the t-shirt, outsourcing the production using cotton from company D (Scenario 4) and having access to the data from company D**

Company B is in situation 2, and can choose between Option 1 and Option 2 for the production of cotton used for the production of the final t-shirt. It therefore needs to (see DNM):

- Use company-specific activity data for transport (distance), and substitute the sub-processes used for electricity mix and transport with supply-chain specific EF compliant datasets (DQR≤3.0)*
- Re-evaluate the DQR criteria within the product specific context

or

- Provide company-specific data (as requested in the PEFCR) and create a company-specific dataset, in aggregated form (DQR≤1.5)
- Calculate the DQR values (for each criterion + total)

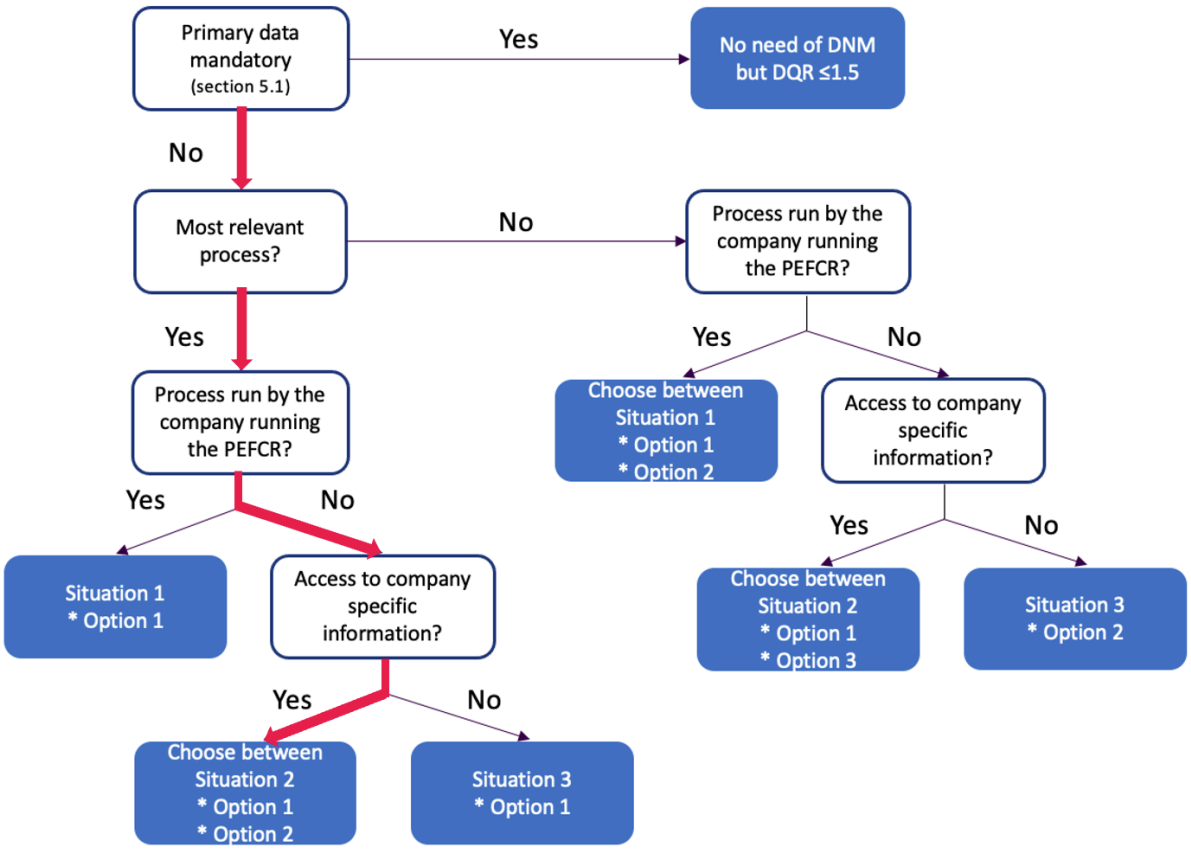



Figure A.VIII 5 - DNM decision tree for Scenario 2 / company B

**Scenario 3: company C commissions the PEF study of the t-shirt, with own assembly process of the final product**

Company C is in situation 1 and can choose between Option 1 and 2 for the assembly process of the t-shirt, and therefore needs to (see DNM):

- Use default secondary dataset in PEFCR, in aggregated form (DQR≤3.0)
- Use the default DQR values

or

- Provide company-specific data (as requested in the PEFCR) and create a company-specific dataset, in aggregated form (DQR≤1.5)
- Calculate the DQR values (for each criterion + total)

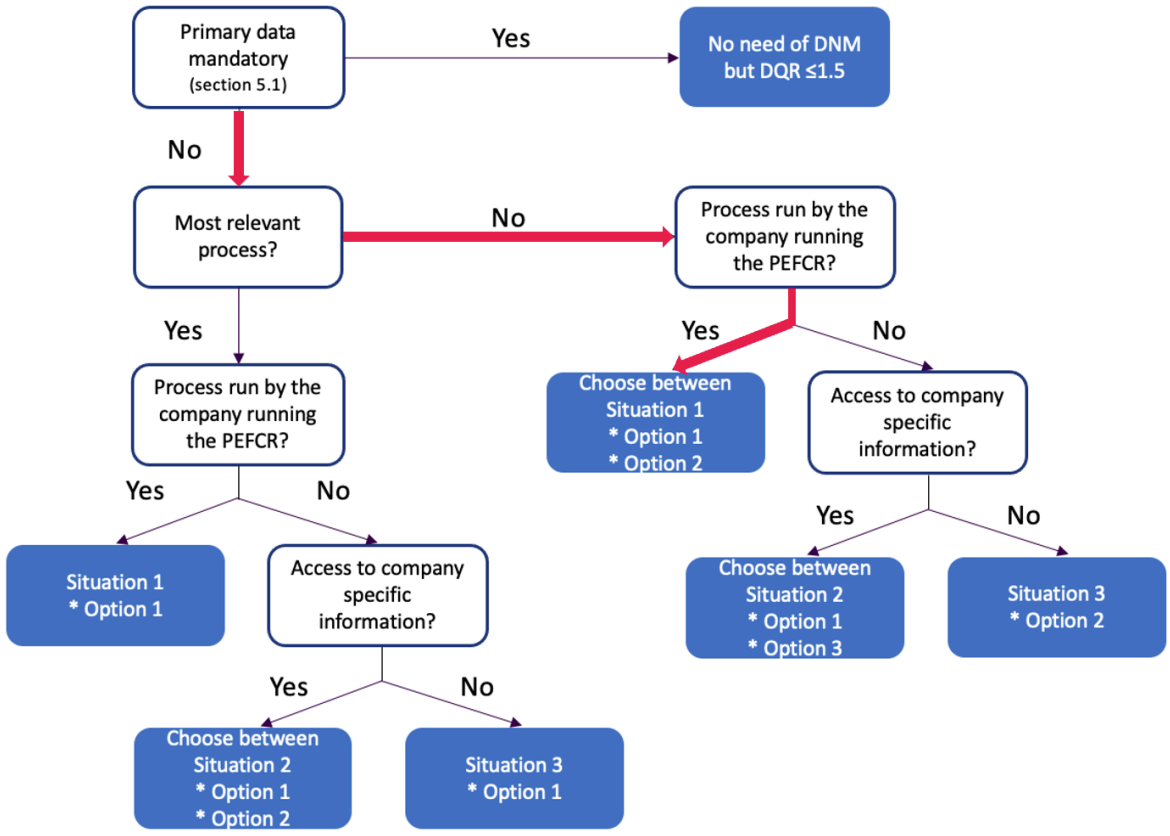



Figure A.VIII 6 - DNM decision tree for Scenario 3 / company C

**Scenario 4: company D commissions the PEF study of the t-shirt, with own production of cotton**

Company D is in situation 1, Option 1 to produce cotton used for the production of the final t-shirt, and therefore needs to (see DNM):

- Provide company-specific data (as requested in the PEFCR) and create a company-specific dataset, in aggregated form (DQR≤1.5)
- Calculate the DQR values (for each criterion + total)

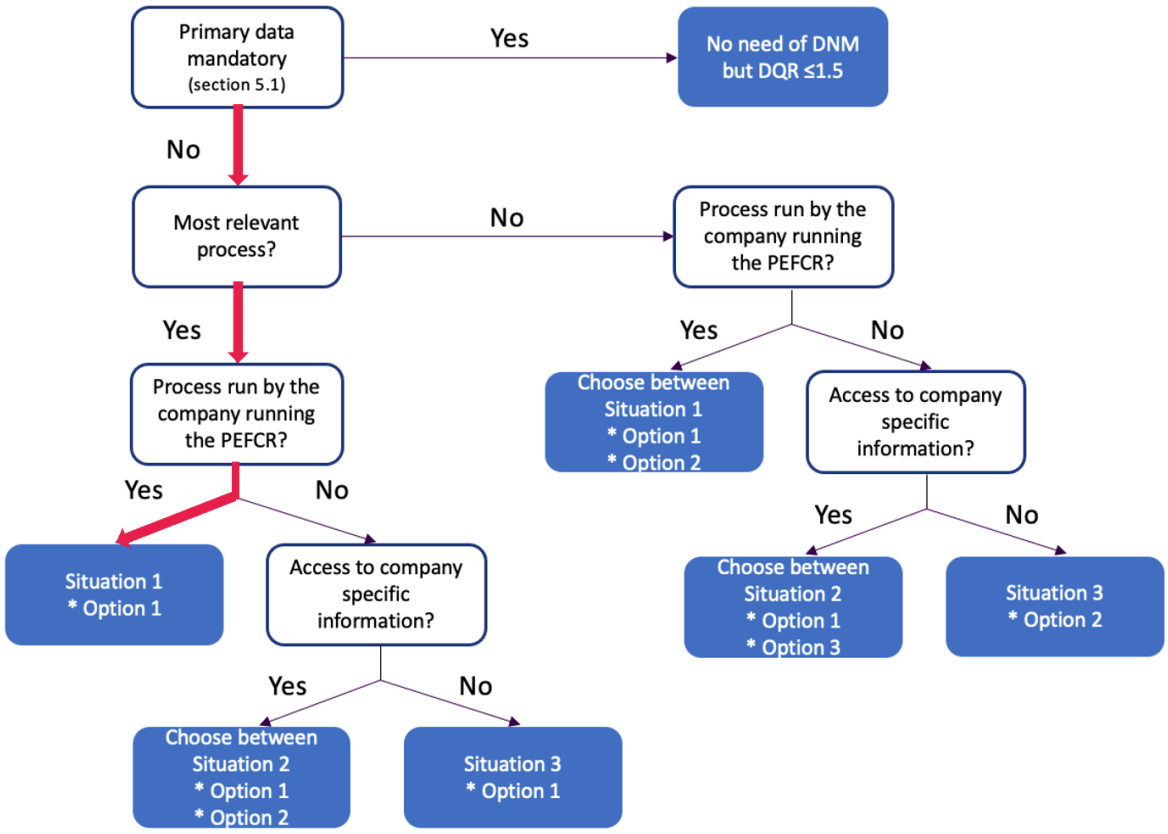



Figure A.VIII 7 - DNM decision tree for Scenario 4 / company D

# ANNEX IX – List of organisations and individuals participating in the public consultations

Due to the large number of respondents to the public consultations on the Apparel & Footwear PEFCR, the names of the participating organisations and individuals is included in this Annex.

**First public consultation**

The first public consultation took place from 7 July 2021 to 24 September 2021, on the PEFCR for apparel and footwear stakeholder workspace.

A total of 996 comments were received from the following organisations:

Table A.IX 1 - Participants to the first public consultation

| Company | Name |
|---|---|
| A W Hainsworth & Sons Ltd. | Diane Simpson |
| AASMB | Sally Hicks |
| ADEME | Autret |
| Australian Superfine Woolgrowers Association | Catherine Hayne |
| Bahariye Mensucat A.S. | SANSAL CETIN |
| Benetton Group | Roberto Taiariol |
| BKB Ltd | Lindsay Humphreys |
| Blaikie Science Solutions | Frances Blaikie |
| Botto Giuseppe e Figli Spa | Silvio Botto Poala |
| British Wool | Haldi Kranich-Wood |
| Campaign for Wool | Marshall Allender |
| Cape Wools SA | Deon Saayman |
| Cashmere and Camel Hair Manufacturers Institute | Fabio Garzena |
| Chambre Syndicale des Laines de France | Anne-Laure Milhe |
| Clear Fashion | n/a |
| CLEON | CLEON J |
| Collectif Tricolor, France | Pascal Gautrand |
| Consumption Research Norway, Oslo Metropolitan University | I.G. Klepp and K. Laitala |
| COTANCE | Gustavo G-Quijano |
| Cotton Council International | n/a |
| CTCP-APICCAPS | n/a |
| Ecoinnovazione | Alessandra |
| ECOS | Valeria Botta |
| EEB | n/a |
| Ellen MacArthur Foundation | Carsten Wachholz |

| Company | Name |
|---|---|
| En Mode Climat : a movement of 200 French brands demanding more regulation to fight climate change | Guillaume Declair |
| ERAM | Gauthier Bedek |
| Ermenegildo Zegna Group | Fulvio Benetti |
| EurEau | Rafael Heredero |
| FAIRLY MADE | Clément AUMAND |
| FAIRLY MADE | Leïla GIMENO |
| FAIRLY MADE | Pierre DIENOT |
| Fédération de la maille, de la lingerie et du balnéaire (FMLB) - France | Mathilde LESPETS |
| Fédération Nationale Ovine | Audrey Desormeaux |
| Federation of Norwegian Industry Textile & Clothing Sector. + Norwegian Fashion & Textile Agenda | Kjersti Kviseth |
| FFC | Guilloux Bonnet |
| FFILC / CLUB LAINE | Joëlle DA FONSECA RUELLAN |
| Fibershed | Heather Podoll |
| FICE | Miriam |
| Fratelli Piacenza S.P.A. | Ettore Piacenza |
| French Ministry for Environment Ministère de la transition écologique (CGDD) | Pascal Dagras |
| Friends fo the Earth Norway | Janne Gilgren |
| G Modiano Ltd. | Michael Modiano |
| G.Schneider | Giovanni Schneider |
| GEMO | Isabelle R. |
| Global Organics Textile Standards | Christopher Stopes |
| Hess Natur | Oppenländer |
| HUGO BOSS | Heinz Zeller |
| Humeau-Beaupreau | AC HUMEAU |
| INESCOP | n/a |
| International Sericultural Commission, Bengalore, India (www.inserco.org) | Dileep Kumar R, Programme Coordinator |
| IVGT | Schmidt |
| Lanecardate spa | Chiara Bianchi Maiocchi |
| Leather UK | Kerry Senior |
| Marzotto Wool Manufacturing | Vincenzo Tumino |
| MOHAIR SOUTH AFRICA | Jackie Gant |
| National Council of Wool Selling Brokers of Australia (NCWSBA) | Paul Deane, Executive Director |
| NEF coordinator | Charlotte Thy |
| Nejdecka cesarna vlny a.s. | Ladislav Mikes |
| New South Wales Farmers Association Wool Committee | Hellen Carrigan |
| Norwegian Network for Sustainable Textiles | Janne Gilgren (Friends of the earth Norway), Siv Elin Ånestad (Future in our hands Norway), Tone Skårdal Tobiasson (Nice Fashion) |
| Pantex spa | Piercarlo Zedda |

| Company | Name |
|---|---|
| Ratti spa | Massimo Lolli |
| Segard Masurel | Olivier Segard |
| Servizi e Seta | Giovanni Schneider |
| Sphera - EF Helpdesk | Daniel Thylmann, Lana Reid-McConnell, John Jewell |
| Successori Reda S.p.A. | Luca Bruschi |
| Suedwolle Group Italia SPA | Davide Marcante |
| Suedwollegroup | Lindner |
| Swedish EPA/Swedish Life Cycle Center | Björn Spak |
| t+m | Eckert |
| The Woolmark Company | Ella Edwards |
| UICSO | JEGOU |
| UIT | Eric BOEL |
| Union des Industries Textiles Sud (UIT Sud) | Richard RICO |
| Vitale Barberis Canonico | Lucia Bianchi Maiocchi |
| WAFarmers | Jessica Wallace |
| Worldproducers Australia | Jo Hall |
| Yukan (Glimpact) | Frédéric Bettens, Klara Cielen & Edgar Towa |
| Zegna Baruffa Lane Borgosesia S.p.A. | Alfredo Botto Poala |

**Second public consultation**

The second public consultation took place from 18 March 2024 to 28 April 2024, on the PEFCR for apparel and footwear stakeholder workspace.

A total of 5119 comments were received from the following organisations and individuals:

Table A.IX 2 - Participants to the second public consultation

| Organization | Name(s) |
|---|---|
| Aust Dohne Breeders Association | Greg Hall |
| "Banda Grazing" Bungarby Road Bungarby NSW 2630 | Greg Alcock |
| "Briidlesdale", 820 Slacks Creek Road, COOMA NSW 2630 | W & J Crowe |
| "Nelenia" | Robin Guthrie |
| "Oakvale" 1038 Corrowong Road Delegate 2633 NSW | Stuart Reed |
| "Redhill" Tombong Rd, Delegate, NSW, Aust | Milton Ingram |
| "Rowensville Merino Stud", St Helens Vic., 3285 | DF & SJ Rowbottom |
| "TBM FARMS" Bungarby Road Bungarby NSW 2630 | Thomas Alcock |
| A & W Anderson | Lynley Anderson |

| Organization | Name(s) |
|---|---|
| Achill Station Pty Ltd | Charles Coventry |
| ADAPTA | Virginie Ducatillon |
| AgForce Queensland, Sheep Wool and Goats Board | Jaime Colley |
| AJ & PA McBride Ltd | |
| Alliance du Commerce | Pierre-Alexandre Naud |
| Aloeburn Pastoral Co. | Andrew and Jodie Green |
| Alpakaleben GmbH | Stefanie Hagner |
| AOS | Davide Colletto |
| AR&HJ McInness | |
| Asociación Civil Alpaca del Peru | |
| Assocalzaturifici, Italian Footwear Manufacturers' Association | Matteo Scarparo |
| Australian Associaiton of Stud Merino Breeders | Sally Hicks |
| Australian Association of Stud Merino Breeders | Geoff Davidson |
| Australian Council of Wool Exporters and Processors | Scott Williams |
| Australian Superfine Woolgrowers Association Inc | Mark Waters, Catherine Hayne |
| Australian Wool & Pastoral Agency Limited Trading As Schute Bell Badgery Lumby | |
| Australian Wool Exchange (AWEX) | Katyana Armen |
| Australian Wool Innovation | Angus Ireland, Edward Fernie, Geoff Lindon |
| Australian Wool Innovation / The Woolmark Company | Sue Pownall |
| Barrington Pastoral Pty Ltd | Sarah Barrington |
| Beaufort | Lyn Heenan Arkuna |
| Bella Lana Merino Stud NSW | Scott Brien |
| Ben Swain | Waterside Grazing |
| BESTSELLER A/S | Anneke Keuning, Henrik Sand, Anneke Keuning |
| Bigpont | Anne Charles |
| Billigaboo Corriedales | RI & JL Carter |
| Bin Bin Station | Philip Clarke |
| BKB Ltd | Geoff Kingwill |
| Bowman Classing & Consultants | Chris Bowman |
| BRENNAN AGRICULTURE | Kristy Brennan |
| Brett Staniland | |
| Bundemar | Tom Kirk |
| Bunka Fashion Graduate University | Shigeru Yasue |
| BUNSHA SAS (brand KIABI) | Océane Dussart |
| Burnt Hut Partnership | Charles Hood |
| Bylands Creek Kolonga Pastoral | Sarah Thomson |
| Calcookara Stud | Brenton and Jane Smith |
| Calga Pty Ltd | Margie Pye C |
| Canadian Wool Council - Campaign for Wool in Canada | Lidiya Beida |

| Organization | Name(s) |
|---|---|
| Cannon Partners Family Trust | Adam Cannon |
| Carbon Trail | Ashish Rohil, Shantanu Singh |
| Carmichael & Co Woolbrokers | |
| Cascale (formerly Sustainable Apparel Coalition) | Joël Mertens |
| CCMI | |
| Changing Markets Foundation | |
| Chargeurs Luxury Fibers | Carolina Borlandelli, Federico Paullier, Maria Estrada, Maria Martirena, Martin Donagaray, Nicolas Sapelli |
| Classic Pastoral Company Pty Ltd | Sandra Heal |
| Clear Creek Holdings | Belinda Steers |
| Clear Fashion | Louise Bertotto, Marguerite Dorangeon |
| Commercial Merino Breeders Association, Australia | Chris Croker |
| Coota Kelso Stabilised Genetics Cootamundra NSW Australia | David Alexander |
| Coromandel Poll Merino Stud | Michael Campbell |
| COTANCE | Gustavo G Quijano |
| Cotton Incorporated | Michele Wallace |
| COUGHLAN INVESTENTS | John Coughlan |
| Cousins Merino Services | Joshua Cousins |
| CT Merriman & Son | Jonathan Merriman |
| D.D. Kaylock & Co | Laura Martin |
| Decathlon | Antoine Cosne |
| DEFI | Elise Desrues |
| Delatite Grazing Pty Ltd, Mansfield, Victoria 3722, Australia | Mark Ritchie |
| Depratment of Agriculture, Falkland Islands Government | Lucy Ellis |
| Devold of Norway | |
| DP & DJ Lawrence & Sons | |
| EAMON | |
| Ebert Sheep Farm | Jeff Ebert |
| Eco-Age | |
| ECOEFF LAB | Philippe Schiesser |
| ECOS | Luca Boniolo |
| EEB | Emily Macintosh |
| Engraw S.A | |
| ETAM GROUP | Laura Lelouard, Kachen Hong |
| EURATEX | |
| EUROCOTON | |
| European Footwear Confederation (CEC) | Carmen Arias |
| Fairly Made | |
| FEAT COOP | Tristan Vuillet |

| Organization | Name(s) |
|---|---|
| Fédération Française de la Chaussure | Mme Michelle Guilloux-Bonnet |
| Ferlyn Pty Ltd | |
| FESI | |
| FHCM | Léonore Garnier |
| Fibershed NL | Heather Podoll, Stijntje Jaspers |
| Firgrove Pastoral Pty Ltd | |
| Footwear & Leather Research and Technological Centre: INESCOP | Borja Mateu |
| Fox & Lillie Pty Ltd | David Martin, Duncan Clarke, James H. Lillie |
| Fox & Lillie Rural | Jeff Angel, Joshua Beer, Shane Ridley, Justin Beer, Toby Haylock |
| Fresh Eyre Merino | |
| G.Modiano Limited | E. Avigdor |
| G.SCHNEIDER S.P.A. | Guillermo Gallia |
| German Environment Agency | Kristin Stechemesser, Brigitte Zietlow |
| GJL Kiss & Co Pty Ltd | Stephen Kiss |
| Glenelg Estate | Charles Downie |
| Glimpact (YuKan) | Adrien Lopes, Christophe Girardier, Klara Cielen |
| GOOD FABRIC - FOOTBRIDGE | Louis Marie Vautier |
| Graham Advisory Pty Ltd | Phillip Graham |
| Grant Burbidge Burbidge Farms 1100 Wstbrook Road Tarcutta NSW Australia | |
| Grasim Industries Limited-Jayashree Textiles | Vivek Kumar Singh |
| Greendale Merinos | Mark McGufficke, Miranda McGufficke |
| GreenroomVoice | Cira Riedel, Anna Rodewald |
| Grootplaas | Jason Butterworth |
| Gum Hill Pty Ltd | Justin Lines |
| Gundarimbah Merinos | Grant Orr |
| H&M | Canan Tutuncu, Goker Kahraman, Laura Cars, Ravinder Tuteja, Viktoria Söderberg |
| HAIX®-Schuhe Produktions- und Vertriebs GmbH | Florian Schmidt |
| Hart Lagoona Pty Ltd | Richard Hart |
| Hillsea station Trust | Michelle Nuske |
| HJ & SM BULL | |
| HRL Farming Pty Ltd | Josh Nuske, Stephen Nuske |
| Ian Campbell & Son | MA Campbell & GT McMullan |
| ICAC | Eric Trachtenberg |

| Organization | Name(s) |
|---|---|
| Members of Durhabi:<br><br>AGNES B - ATLAS FOR MEN - AUBADE - AUCHAN - BALZACE PARIS - BASH - BONNE GUEULE - BONNETERIE D'ARMOR - BONOBO - BREAL - BS PRODUCTION - BZB - CACHE CAHCE - CAROLL - CARREFOUR - ELIO - CHANTELLE - CLAUDIE PIERLOT - COMPTOI DES COTTONNIERS - CREATION & IMAGE PARIS - DAMART - DARJEELING -DCMJ (JENNYFER) - DECATHLON - DEVERD1902 - EMINENCE - ERIC BOMPARD - ETAM - FST HANDWEAR - FURSAC - GALERIES LAFAYETTES - GEMO - GO SPORT - GRAIN DE MALICE - IKKS - INTERSPORT - JACADI - JULES - KIABI - LA HALLE - LA REDOUTE - LACOSTE - LAFUMA - LE BOURGET BODYWEAR - LE SLIP FRANÇAIS - LEMAHIEU - MADE IN SENS - MAISON 123 - MAJE - MILLET MOUNTAIN - MONOPRIX - MORGAN - NEW WAVE FRANCE - OBAIBI - OKAIDI - OLLY PIMKIE - PRINCESSE TAM TAM - PROMOD - ROUGE GORGE - SAINT JAMES - SANDRO - SEZANNE - SIMONE PERELE - SMOOM LINGERIE - TAPE A L'OEIL - TERRES DE MARINS - TRENDETHICS - UNDIZ - UNIQLO - VILEBREQUIN - WELL LINGERIE - WOLF LINGERIE - ZYGA | |
| IFTH | Carole Garbowski |
| INCA BRANDS INC. | Kim Brooks |
| Independent Commodity Services P/L | Andrew Woods |
| IndiDye Natural Color Technology Company | |
| Innisvale Pastoral Co | Michael Lowe |
| International Alpaca Association | |
| International Fur Federation | Marianne Coulavin |
| Intertek HK | Simon Tse |
| IWTO | Klaus Steger |
| IWTO | |
| Jemalong Wool Pty Ltd | Rowan Woods |
| Jogilma EH | Greg Williams |
| Joyce Ventures PL | Tom Joyce |
| Jumbuck Plains | Michelle Fowler |
| KALGARA MERINOS | DH& SH CALVERT |
| Kangaroo Island Wool Pty Ltd | Greg Johnsson |
| KELLER PARTNERS | Craig & Jed Keller |
| Kenton Ag | |
| Kettlewell Consulting | |
| Kia Ora Merino | Susan Finnigan |
| Kirby McPhee and Bathurst Merino Association Inc. | |
| KL Albrechtsen & SJ Eckert | Karen Albrechtsen & Stephen Eckert |
| L Mortimer & Sons | Robert Mortimer |

| Organization | Name(s) |
|---|---|
| La Belle Empreinte | Delphine Droz |
| Lake Hamilton Pastoral | Ryan & Lisa Boot |
| Lawson Grains | Sam Pateman |
| Leahcim Farming | Andrew Michael |
| Lenzing AG | |
| Lincoln Rural Supplies Pty Ltd | |
| Livestock Breeding Services Pty Ltd Australia | Michelle Humphries |
| Livestock GeneTEx | Michael Blake |
| Livestock SA Incorporated | Travis Tobin |
| Lone Pine Merinos | Ron Mackay |
| Lynford Farms Pty Ltd | |
| M & P Cuming | |
| Macaulayglovers | |
| Macdonald & Co Woolbrokers | Don Macdonald |
| Maharatta Partnership | Charles Hood |
| maki Consulting gmbh | Kirana Wolf |
| Målbar | Anders Koefoed |
| Mascot International A/S | Mette Schulin-Zeuthen |
| McGuiness Farms | Tom McGuiness |
| Merambego Bungarby | John & Jenny Alcock |
| Merino SA | Lin Cowling |
| MH Enterprizes | Michael Hollow |
| Mid Sweden University | Judith Waller |
| Millabong Pastoral Co. | Colin & Amanda McCrabb |
| Mirridong Food and Fibre | Todd Burger |
| Modiano Australia Pty Ltd | Stuart Clayton |
| Monaro Farming Systems | Mandy Horton |
| Morley Poll Merino Stud | Leonie Mills |
| Moses & Son | Abby Byrnes, Adele Smith |
| Mt Buckalnd farm | Robert Kingam |
| Mt William Ag Pty Ltd | |
| Mullengudgery Pty Ltd | Thomas Moxham |
| Murdoch Bibbenluke | |
| Myrtlewood Pastoral | Madeleine Scott |
| Nargong Partnership | Stephen Rutledge |
| Nejdecká česárna vlny a.s. | Ing. Ladislav Mikeš |
| Nike | Adam Brundage, Josh Sohn, Megann Head, Rosemary Han |
| Nordenfjeldske Fibershed | |
| North Bundy Pastoral Company Pty Ltd | Peter McCrabb |
| North Cuerindi, Manilla NSW 2346 | Rupert Steel |

| Organization | Name(s) |
|---|---|
| O&J Cay, Pineleigh, Bungarby NSW 2630 | Oliver Cay |
| OKAIDI | Nina Carmellino |
| Old Cobran Pastoral | Matthew Martin |
| Oscit Pty Ltd | Stephanie Croker |
| Oslo Metropolitan University | |
| Oster Farming | Elden Oster |
| P Sprigg & Co, Ebenezer Poll Merinos | Stephen Sprigg |
| PA & LM Kammermann | Phillip Kammermann |
| Paling Yards Trading Co | Richard Bell |
| Penrose Pastoral | Bruce Pengilly |
| Portuguese Footwear and Allied Trade National Industrial Association: APICCAPS<br>& Research and Technological Centre: CTCP | Maria José Ferreira |
| Quinburra Partnership | Ron Horton |
| Reda | |
| Resortecs | Rawaa Ammar |
| RIDGWAY ADVANCE | David Ridgway |
| Robin Schwartz | |
| Rolfe Agriculture | Andrew Rolfe |
| Rosedale Pastoral Co | Alan Rissmann |
| Roseville Park Merino Stud Pty Ltd | Cherie Coddington |
| Rosewood Wool Services | Andrew Dennis |
| RPM Livestock Pty Ltd | Matthew Coddington |
| Rural Data Management Services Pty Ltd | Mike Kirke |
| S & J Green | |
| SA & JM Gregory | Shaun Gregory |
| Salomon | Alix Poitou |
| Saralco Partnership | Simon Cameron |
| Segard Masurel S.A.S. | Olivier Segard |
| Sézane | Alexandra De Toni |
| SheepMetriX | Sally Martin |
| Shinshu University | Yasuyuki Cho |
| SJ & JL Makeham | Simon & Justine Makeham |
| Smart Rural Services | Chloe Smart |
| Southern Aurora Markets Pty Ltd | |
| Spring Hills KI | Jonathan & Rosalie Bell |
| STOCK PTY LTD | Devon Ridgway Ridge |
| Stucken Group | Anthony Kirsten |
| Suedwolle Group | Michel Mastio, Mirko Lindner |
| SUL | Ignacio Abella |
| Sustainable Brand Platform | |
| Swedish Environmental Protection Agency | Björn Spak |

| Organization | Name(s) |
|---|---|
| Sykes Grazing | Adrian Sykes |
| T.A Field Estates Pty Limited | Michael Field |
| Talaheni/Yass ultrafine wool grower | John Ive |
| Talmo Pastoral company | Chris Shannon |
| Talooby Trust | Bruce Allworth |
| Tarrangower Merinos | |
| TH Brown & Sons / member of Seymour Wool Marketing Group | Robert & Michelle Brown |
| The New Zealand Merino Company | Natalie Norman |
| The Woolmark Company | Alexis Zhang, Angela Jabara, Catherine Veltman, Cherry He, Flora Zheng, Xiaoxu Zhou |
| The Yanko Grazing PTY LTD | Hugh Cameron |
| ThreeLakes Elliston SA 5670 | Nigel & Debbie May |
| Tintagel Pastoral Co Pty Ltd | Charles Hood |
| Tod's Group | |
| Toulon Pastoral Company | |
| Tralee Grazing | Brett Smith |
| Tumbleton Partnership | Gemma Wilkinson |
| U.S. Cotton Trust Protocol | |
| Ullingala Pastoral Company - Gunnegalderie Merinos | |
| Union des Industries Textiles | Sophie Frachon |
| UPTRADE, ADAPTA, Paris, France | Charlotte Billot |
| Vet Consultant | Bruce Jackson |
| VictorianStud Merino Sheep Breeders Association | Alan Harris |
| Wandobah Pastoral Dunkeld Victoria Australia | Craig Oliver |
| Ward Family Pastoral Co | |
| Warooka Pastoral Company | Kym Lyons |
| Warrembool Pty Ltd | Charles Cay |
| WattleDale | David Vandenberghe, Katherine Vandenberghe |
| WAUGH PICCADILLY | Angus Waugh |
| Wheare Holdings | Craig Wheare |
| Whitehill Poll Merinos | Chris Ruediger |
| Willowvale | John Eliott |
| Women in Wool | Victoria Fish |
| Woodside Moutajup | |
| Woodstock Pastoral | Darcy Larritt |
| Wool Impact | Gretchen Foster |
| Wool in School | Lorna McCormack |
| Woolmark Americas | Elin Arnott |
| WoolProducers Australia | Jo Hall |
| Xeros Technology Group | Paul Servin |

| Organization | Name(s) |
|---|---|
| - | A J Hall |
| - | André Herbst |
| - | Angela Hawdon |
| - | Brittany Stein |
| - | Bruce and Lynne Michael |
| - | CA Arnold and MH Hood |
| - | Charlotte Pateman & C Pateman |
| - | Craig Mitchell |
| - | David & Andrea Mitchell |
| - | DJ & RA TRIBOLET |
| - | Elisabeth van Delden |
| - | Erksville Bombala |
| - | Garry Preston |
| - | GRADY & NONI OBST R & O RURAL |
| - | GS & TD Parker |
| - | Helen R Clark |
| - | Jens Kraus |
| - | Martin Moses |
| - | Michael Campbell |
| - | Michael McMeniman |
| - | ML Rowe |
| - | Monica Ebert |
| - | Peter Maher |
| - | Peter Thornton |
| - | Peter Wakefield |
| - | R & M Whitby |
| - | Samantha Wan |

# ANNEX X – List of future revision points

This section includes recommendations for a future revision of this PEFCR, i.e. elements that a future Technical Secretariat should revisit.

Topics to to touch upon:

1. Division of Subcategories
    a. Revising and introducing more granularity in the PEFCR categories
    b. Apparel Accessories could be further specified
    c. Underwear division may be needed to reflect differences in care practices
    d. Tights should be separated to account for difference in the Duration of Service
    e. Shoes (further fragmentation to reflect different use and care cases)
    f. Potential addition: workwear; challenge in accounting for considerably different use cases and testing protocols needed to reflect them
2. Biodiversity based on Peer-reviewed and widely accepted research (Kunming-Montreal Protocol)
    a. Should the EU Commission have updated the general PEF method on this matter
    b. Revisit whether organic certifications are the most appropriate proxy indicator while the Commission update is still pending
3. Extrinsic Durability
    a. Integrate a generalised assessment approach based on the latest available research and evidence
    b. Consider its weighting vis-a-vis other durability factors
4. Intrinsic Durability
    a. Revise benchmarking based on Data Available from the Implementation of the Framework (basic, aspirational, etc.)
    b. Revise Fragmentation of the Durability Testing Protocol based on evidence gathered from the implementation of the current testing protocol, including regarding material composition
    c. Revise the test list of the Durability Testing Protocol as needed
    d. Further expansion of the durability multiplier
    e. Revise the definition of the ‘sport segment’ in Annex V in case of more rigid definition in the ESPR delegated acts
    f. Define separate durability testing protocols for fur and leather
5. Repairability
    a. The calculation of the Multiplier and criteria should be revised based on further emerging evidence
    b. Multiplier weight should be expanded
    c. Country-specific Costs of Repair Services should be revisited

    d. Criterion to be integrated: Designed to be Repaired if sufficient evidence is available
6. Fiber Fragment Approach
    a. Extend Life Cycle Stages Covered with needed evidence
    b. Extending Impact Areas Covered with Needed Evidence
    c. Integration of wastewater treatment measures in the developed approach
    d. Integration into Overall Impact Calculation Pending Revision of PEF Method by the European Commission
7. Representative Products
    a. Revise fibre composition to mirror more recent data on market compositions
    b. Revise material composition for footwear, in particular PVC
8. End-of-Life
    a. Extending Pathways Modeled (in particular: biodegradability, fibre-to-fibre recycling)
    b. revise methane emission factors from apparel and footwear landfilling based on further evidence
9. Default Duration of Service
    a. Revision of the default durations of service based on novel evidence available
    b. Revision of duration of service: separation into adult and children products
    c. Revision of duration of service according to material composition
10. Duration of Service Multipliers
    a. Tights
    b. Material-based revision of DoS (in particular: leather and fur items)
    c. Revision of Subcategories based on further research
11. Washing Frequencies
    a. Global revision pending the publication of new best-available evidence (particular highlights: T-shirt, Socks, Legging, Tights, Socks)
    b. Ski jackets and down jackets washing frequency and scenario should be specified
    c. Revise based on new literature and evidence (global statement)
    d. Underwear washing frequencies should be revisited
12. Manufacturing Leftover Rates
    a. the default rates provided in the PEFCR should be revised based on further market evidence to reflect common practice better
13. Distribution
    a. Revision of the subject of volume-limited transportation
14. Sizing
    a. The standard sizes can be further harmonised, for example by following standards such as ISO 8559, and aligned with other regulations such as the Textile Labelling Regulation.

15. Communication of PEF study results
    a. Should the European Commission impose the communication of PEF results, it should be accompanied by a consumer survey or a consultation on the consumers' needs regarding to the information they wish to have included before it is implemented.
16. Measures to make the Method more Approachable and Relevant (separate into a document to the Commission)
    a. Extend the duration of the public consultation to improve its accessibility
    b. pursue further measures to increase the visibility of public consultations (i.e. press releases)
    c. Integrate the impacts from microplastic releases into the 16 impact calculation of the overarching PEF method (for all life cycle stages)
    d. pursue and support the implementation of research aimed at determining the appropriate weighting of DoS multipliers vis-a-vis one another
    e. develop approachable educational materials to transparently educate on the micro point calculation method of the EF method
    f. Refine the method to develop a separate biodiversity impact calculation and indicator
17. Measures to ensure a smooth implementation of the PEFCR method
    a. Perform a pilot assessment of the effectiveness of the PEFCR method before implementing it in legislative contexts

# ANNEX XI – Calibration sheet for the pre-verification of the IDM calculation module in tools

This annex is provided as a separate .xls document and contains calculation examples for the rules of calculating the IDM for fictitious apparel & footwear products, based on conducted tests and respective test results.