
Sustainable Minds®

## SM Transparency Report [EPD]™ Framework

# Part A

## LCA Calculation Rules and Report Requirements

**Version 4.0 | February 2026**

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# Part A: LCA calculation rules and report requirements

## Table of contents

# 1. Introduction

**This document was created by Joep Meijer, Naji Kasem, and Kim Hammer (Lewis) and is managed and maintained by the Sustainable Minds Technical Advisory Board (TAB) as outlined in ISO 14025:2006.**

This document is part of a series of documents comprising the Sustainable Minds Transparency Report [EPD]™ Framework:

- SM Transparency Report [EPD]™ Framework Governance and Program Rules Version 4.0, February, 2026
- Part A: LCA calculation rules and report requirements (*this document*)
- Part B: Product group definition

The most recent version of these documents as well as all explanatory materials can be found at www.sustainableminds.com, ensuring the transparency and accessibility of the program as outlined in ISO 14025:2006 Clause 5.9, Clause 6.8.1, and Clause 9.2.3. Part A, Part B, and the governance document are structured to allow conformance to the ACLCA PCR Open Standard version 1.0[1] as specified in each Part B.

## 1.1 General

This document is based on public standards and life cycle assessment (LCA) best practice. It conforms to ISO 14040:2006, 14044:2006, ISO 14020:2000, and ISO 14025:2006, and it builds on a vast experience in and expertise of life cycle assessment (LCA) and environmental product declaration (EPD) programs around the world, particularly regarding the application of the ACLCA PCR Open Standard v1.0, and the application of ISO 21930:2017 for building and construction products and services. This document was reviewed by the following review panel:

| | | |
|---|---|---|
| Thomas P. Gloria, Ph. D., Chair<br>Industrial Ecology Consultants<br>t.gloria@industrial-ecology.com | Jack Geibig<br>Ecoform<br>Jgeibig@ecoform.com | Beth Cassese<br>Horizon LCA<br>bcassese@horizonlca.com |

Sustainable Minds solicited public comments on Part A from January 2, 2026 – February 6, 2026. The comments received during public consultation were made available to the review panel.

This is a living document with the intention of continuous improvement. The main driver for this process is the growth in products that have ISO 14025:2006 Type III environmental declarations, also known as Transparency Reports [EPDs]™ or Environmental Product Declarations (EPDs).

The intended application of this document is to provide a common structural set of general rules, requirements, and guidelines applicable to any product in order to ensure that all ISO 14025:2006 Type III environmental declarations based on the Sustainable Minds Transparency Report [EPD]™ Framework are derived, verified, and presented in a harmonized and consistent manner.

An EPD presents the summary of the LCA background report which includes quantified environmental information on the life cycle of a product in information modules. It is created by applying the general rules of this document together with the specific rules of Part B. A verified Transparency Report [EPD]™ is an ISO 14025:2006 conformant Type III environmental declaration (EPD) which communicates verifiable, accurate, and non-misleading environmental information for products and their applications. The creation, development, and use of EPDs are voluntary (in conformance to ISO 14025:2006 Clause

[1] ACLCA PCR Open Standard https://www.aclca.org/initiatives#PCR-Open-Standard

5.2). Modularity in these EPDs allows for consistent and structured organization and communication of data and results throughout the life cycle of a product (in conformance to ISO 14025:2006 Clause 5.3).

EPDs for building and construction products and services shall also conform to ISO 21930:2017. In cases where no applicable PCR exists for building and construction products and services, EPDs may be published in conformance to Part A and ISO 21930:2017. Justification for publishing without a Part B shall be stated in the background LCA report. Examples of construction products are goods, assemblies, and systems that are semi-permanently or permanently incorporated into buildings, civil engineering projects, or other assets, such as products used for structural, envelope, interior, mechanical, and infrastructure applications. For products outside of this definition (i.e., non-construction products), EPDs may be published to Part A in combination with an existing Part B for the applicable product category.

This PCR and associated Part B PCRs in the Sustainable Minds program are developed in English. Translations are unavailable unless otherwise noted.

## 1.2 Scope

This document provides the general rules that apply to any product and is used in the development of an EPD in conjunction with Part B. It specifies the standards of LCA calculation rules as a prerequisite of TRs/EPDs as well as the requirements of the LCA background report. It prescribes inventory data categories and impact category indicators for all EPDs, specifying which are required and which are optional. The assessment of social and economic performance at the product level is not covered in this framework (social performance measures social issues such as human rights, working conditions, and cultural heritage; economic performance measures the materials and energy resources required for, and the environmental emissions resulting from, activities in our economy). Parts A and B establish the principles and specify the procedures for developing an EPD. They further establish the use of the ISO 14040:2006 and ISO 14044:2006 standards in the development of EPDs.

## 1.3 Objectives

Consistent with ISO 14025:2006 Clause 4, the overall goal of the framework is to encourage the demand for, and supply of, those products that cause less stress on the environment, through communication of verifiable and accurate information that is not misleading using a consistent, efficient, harmonized, and user-friendly framework. The goal is to stimulate the potential for market-driven continuous environmental improvement using scientifically-based fair choices. The objectives of EPDs are to:

a) Provide LCA-based information and additional information on the environmental aspects of products
b) Provide information for assessing the potential environmental impacts of products over the life cycle within their system boundaries (see Table 2 for system boundary options)
c) Allow manufacturers to tell their side of the story on their efforts to decrease the stresses on the environment caused by their products
d) Assist purchasers and users to make informed comparisons between products of the same group for cradle-to-grave declarations (these declarations are not comparative assertions)
e) Encourage improvement of potential environmental performance
f) Facilitate manufacturers' transitions and progress towards transparency and sustainability

## 1.4 Principles

The Sustainable Minds Transparency Report [EPD]™ Framework is administered by members of the Technical Advisory Board (TAB) (see the governance document) which oversees the conformance of the framework to the principles outlined in ISO 14025:2006 Clause 5. The TAB acts as an independent third party to organizations and manufacturers and checks the proposed decisions of Part Bs and the framework and makes changes. As a neutral body, it intervenes when conflicts of interest arise.
An overview of changes to this document is available as Appendix B to this document. The development and use of EPDs is voluntary. The Sustainable Minds Transparency Report [EPD]™ Framework provides requirements for an organization choosing to develop and use an EPD.

## 2. References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ACLCA PCR Open Standard v1.0, May 26, 2022. https://www.aclca.org/initiatives#PCR-Open-Standard

Bare, J., Gloria, T. and Norris, G. (2006) Development of the Method and U.S. Normalization Database for Life Cycle Impact Assessment and Sustainability Metrics, Environmental Science & Technology, 40(16):5108-5015

ASHRAE 189.1 2023. Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential 51 Buildings

Bare, J. 2014. Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) TRACI version 2.1 User's Guide. US EPA Office of Research and Development, Washington, DC, EPA/600/R-12/554, http://nepis.epa.gov/Adobe/PDF/P100HN53.pdf

GHG Protocol Product Life Cycle Accounting and Reporting Standard, http://www.ghgprotocol.org/product-standard

Gloria, T. P., B. C. Lippiatt & J. Cooper (2007) Life cycle impact assessment weights to support environmentally preferable purchasing in the United States, Environmental Science & Technology, 41(21):7551-7557

Henderson, A.D., B. Niblick, H.E. Golden, and J.C. Bare. Modeling spatially resolved characterization factors for eutrophication potential in life cycle assessment. International Journal of Life Cycle Assessment, 2021, 26: 1832 – 1846.

International Green Construction Code (IgCC), 2024

ISO 14020:2000, Environmental labels and declarations — General Principles

ISO 14021:2016, Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling)

ISO 14025:2006, Environmental labels and declarations- Type III environmental declarations - Principles and procedures

ISO 14040:2006, Environmental management — Life cycle assessment — Principles and framework

ISO 14044:2006, Environmental Management — Life Cycle Assessment — Requirements and guidelines

ISO 14046:2014, Environmental management — Water footprint — Principles, requirements and guidelines

ISO 14067:2018, Carbon footprint of products — Requirements and guidelines for quantification and communication

ISO 21930:2017, Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services

Ryberg, M., Vieira, M.D.M., Zgola, M. et al. (2014) Updated US and Canadian normalization factors for TRACI 2.1, Clean Technologies and Environmental Policy, 16(2):329-339. doi:10.1007/s10098-013-0629-z

# 3. Terms, definitions, and abbreviations

## 3.1 Terms and definitions

**For the purposes of this document, the following terms and definitions apply.**

NOTE: Terms are not defined where they retain their normal dictionary definition.

- ***Additional technical information*** - information that forms part of the EPD by providing a basis for the development of scenarios [ISO 21930:2017]
- ***Ancillary input*** - material input that is used by the unit process producing the product, but which does not constitute part of the product [ISO 21930:2017]
- ***Comparative assertion -*** environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function [ISO 14044:2006]
- ***Consumer -*** individual member of the general public purchasing or using goods, property or services for private purposes [ISO 14025:2006]
- ***Contractual instrument*** - Any type of contract between two parties for the sale and purchase of energy bundled with attributes about the energy generation, or for unbundled attribute claims [ACLCA Addendum: Guidance for Quantifying Renewable Electricity Instruments in Environmental Product Declarations (EPDs)]
- ***Co-product*** - any of one or more products from the same unit process, but which is not the object of the assessment [ISO 21930:2017]

  NOTE: Co-product and product have the same status and are used for identification of several distinguishable flows of products from the same unit process. Where one of two or more co-products is the object of assessment of the EPD, this is normally considered the product and the other output(s) as the co-product(s). Where one of the co-products is an input to a process, this is normally considered as a product input. From co-product and product, waste is the only output to be distinguished as a non-product. [ISO 21930:2017]
- ***Declared unit*** - quantity of a product for use as a reference unit in an EPD based on LCA, for the expression of environmental information needed in information modules [adapted from ISO 21930:2017 to broaden definition from construction products to all products]

  EXAMPLE: 1,000 kg (mass), 1 $m^3$ (volume), 10 $m^2$ (area) [adapted from ISO 21930:2017 to include quantity and area]
- ***Environmental aspect*** - element of an organization's activities, products or services that can interact with the environment [ISO 14040:2006]
- ***Environmental declaration*** - claim which indicates the environmental aspects of a product or service [ISO 14025:2006]

  NOTE: An environmental label or declaration may take the form of a statement, symbol or graphic on a product or package label, in product literature, in technical bulletins, in advertising or in publicity, amongst other things [ISO 14025:2006]
- ***Functional unit*** - quantified performance of a product system for use as a reference unit [ISO 14040:2006]
- ***Information module*** - compilation of data to be used as a basis for a Type III environmental declaration, covering a unit process or a combination of unit processes that are part of the life cycle of

a product [ISO 14025:2006]

- ***Life cycle*** - consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal [ISO 14040:2006]
- ***Life cycle assessment (LCA)*** - compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle [ISO 14044:2006]
- ***Life cycle inventory analysis -*** phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle [ISO 14040:2006]
- ***Life cycle impact assessment*** - phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product [ISO 14040:2006]
- ***Non-renewable resource*** - resource that exists in a fixed amount that cannot be naturally replenished or cleansed on a human time scale [ISO 21930:2017]
- ***Performance*** - ability of a product or service to fulfil required functions under intended use conditions [adapted from ISO 21930:2017]
- ***Potential environmental impact*** - possible environmental impact based on the data and assumptions underlying the life cycle inventory and the life cycle impact assessment methodology used in an LCA study [ISO 14040, section 4.3]

  NOTE: LCA addresses potential environmental impacts; LCA does not predict absolute or precise environmental impacts due to
  - the relative expression of potential environmental impacts to a reference unit,
  - the integration of environmental data over space and time,
  - the inherent uncertainty in modelling of environmental impacts, and
  - the fact that some possible environmental impacts are clearly future impacts [ISO 14040, section 4.3]
- ***Potential environmental performance*** - performance related to potential environmental impacts and environmental aspects [adapted from ISO 21930:2017 to reflect potential impacts]
- ***Post-consumer recycled content*** - material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose. This includes returns of material from the distribution chain. [ISO 14021]
- ***Pre-consumer recycled content*** - material diverted from the waste stream during a manufacturing process. Excluded is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it. [ISO 14021]
- ***Product*** - any good or item manufactured or processed, or any service or activity that supports processes [adapted from ISO 21930:2017]
- ***Product category*** - group of products that can fulfill equivalent functions [ISO 14025:2006]
- ***Product category rules (PCR)*** - set of specific rules, requirements and guidelines for developing Type Ill environmental declarations for one or more product categories [ISO 14025:2006]
- ***Power purchase agreement (PPA)*** - A type of contract that allows a consumer, typically large industrial or commercial entities, to form an agreement with a specific energy generating unit. The contract itself specifies the commercial terms, including delivery, price, payment, etc. In many markets, these contracts secure a long-term stream of revenue for an energy project. In order for the consumer to say they are buying the electricity of the specific generator, attributes shall be contractually transferred to the consumer with the electricity [ACLCA Addendum: Guidance for Quantifying Renewable Electricity Instruments in Environmental Product Declarations (EPDs)]

- ***Product system*** - collection of unit processes with elementary and product flows, performing one or more defined functions, and which models the life cycle of product [ISO 14040:2006]
- ***Program operator*** - body or bodies that conduct a Type Ill environmental declaration program [ISO 14025:2006]

  NOTE: A program operator can be a company or a group of companies, industrial sector or trade association, public authorities or agencies, or an independent scientific body or other organization [ISO 14025:2006]
- ***Renewable energy certificate (REC)*** - A type of energy attribute certificate (EAC) used in the U.S. and Australia. In the U.S., a REC is defined as representing the property rights to the generation, environmental, social, and other non-power attributes of renewable electricity generation. One REC equates to one MWh of renewable energy production. [ACLCA Addendum: Guidance for Quantifying Renewable Electricity Instruments in Environmental Product Declarations (EPDs)]
- ***Reference service life (RSL)*** - service life of a product which is known to be expected under a particular set of reference in-use conditions and which may form the basis of estimating the service life under other in-use conditions [adapted from ISO 21930:2017 to broaden definition from construction products to all products]
- ***Renewable resource*** - resource that is grown, naturally replenished or naturally cleansed on a human time scale [ISO 21930:2017]

  NOTE: A renewable resource is capable of being exhausted but can last indefinitely with proper stewardship. Examples include trees in forests, grasses in grassland and fertile soil, and wind. Activities that occur in the technosphere such as recycling are not considered natural replenishment or cleansing. In this context, human time scale refers to the typical life time of a human rather than the time humans have been in existence. [ISO 21930:2017]
- ***Secondary fuel*** - fuel recovered from previous use or from waste, derived from a previous product system and used as an input in another product system [ISO 21930:2017]

  NOTE 1: Processes providing a secondary fuel are considered from the point where the secondary fuel enters the system from the previous system [ISO 21930:2017]

  NOTE 2: Secondary fuels can be recovered from previous use or from wastes such as solvents, wood, tires, oil, animal fats [ISO 21930:2017]

  NOTE 3: Secondary fuels can be renewable or non-renewable, depending on the status of the material before it became waste [ISO 21930:2017]
- ***Secondary material*** - material recovered from previous use or from waste derived from another product system and used as an input in another product system [ISO 21930:2017]

  NOTE 1: Secondary material is measured at the point where the secondary material enters the system from another system [ISO 21930:2017]

  NOTE 2: Examples for secondary materials are recycled scrap metal, crushed concrete, glass cullet, recycled wood chips and recycled plastic granulate [ISO 21930:2017]
- ***Scenario*** - collection of assumptions and information concerning an expected sequence of possible future events [ISO 21930:2017]
- ***Specific data*** - data representative of a product, product group or service, provided by one supplier (e.g., the declaring organization), either from multiple plants or based on multiple similar products of the supplier [adapted from ISO 21930:2017 to broaden definition from construction products to all products and to specify the supplier as the declaring organization]
- ***Third party*** - person or body that is recognized as being independent of the parties involved, as

concerns the issues in question [ISO 14025:2006]

NOTE: "Parties involved" are usually supplier ("first party") and purchaser ("second party") interests [ISO 14025:2006]

- ***Type III environmental declaration*** - environmental declaration providing quantified environmental data using predetermined parameters and, where relevant, additional environmental information [ISO 14025:2006]

  NOTE 1: Predetermined parameters are based on the ISO 14040 series of standards, which are comprised of ISO 14040 and ISO 14044 [ISO 14025:2006]

  NOTE 2: The additional environmental information may be quantitative or qualitative [ISO 14025:2006]

- ***Type III environmental declaration program*** - voluntary program for the development and use of Type III environmental declarations, based on a set of operating rules [ISO 14025:2006]
- ***Unit process*** - the smallest element considered in the life cycle inventory analysis for which input and output data are quantified [ISO 14040:2006]
- ***Upstream, downstream process*** - process(s) that either precedes (upstream) or follows (downstream) the designated process in the stream of relevant processes [adapted from [ISO 21930:2017]
- ***Verification*** - confirmation, through the provision of objective evidence, that specified requirements have been fulfilled [ISO 14025:2006]
- ***Verifier*** - person or body that carries out verification [ISO 14025:2006]
- ***Water use*** - use of water by human activity [ISO 14046:2014]

  NOTE 1: Use includes, but is not limited to, any water withdrawal, water release or other human activities within the drainage basin impacting water flows and/or quality, including in-stream uses such as fishing, recreation, transportation [ISO 14046:2014]

  NOTE 2: The term “water consumption” is often used to describe water removed from, but not returned to, the same drainage basin. Water consumption can be because of evaporation, transpiration, integration into a product, or release into a different drainage basin or the sea. Change in evaporation caused by land-use change is considered water consumption (e.g. reservoir). The temporal and geographical coverage of the water footprint assessment should be defined in the goal and scope. [ISO 14046:2014]

- ***Waste*** - substances or objects which the holder intends or is required to dispose of [ISO 14040:2006]

## 3.2 Abbreviations

| | |
|---|---|
| CAS | Chemical abstracts service |
| CFC | Chlorofluorocarbon |
| CML | Centrum voor Milieuwetenschappen Leiden |
| $CO_2$ | Carbon dioxide |
| CSI | Construction Specifications Institute |
| CTU | Comparative toxicity unit |
| EN | European standard maintained by CEN (European Committee for Standardization) |
| EPA | Environmental Protection Agency |
| EPD | Environmental product declaration |
| $ft^2$ | Square foot (also square feet) |
| ISO | International Organization for Standardization |
| kg | Kilogram |
| km | Kilometer |
| lb | Pound |
| LCA | Life cycle assessment |
| LCI | Life cycle inventory |
| LCIA | Life cycle impact assessment |
| LEED | Leadership in Energy and Environmental Design |
| $m^2$ | Square meter |
| $m^3$ | Cubic meter |
| mm | Millimeter |
| MJ | Megajoule |
| MND | Module not declared |
| N | Nitrogen |
| NIST | National Institute of Standards and Technology |
| $O_3$ | Ozone |
| PCR | Product category rule (also product category rules) |
| PM | Particulate matter |
| POC | Program Operator Consortium |
| RSL | Reference service life |
| sq ft or sf | Square foot (also square feet) |
| $SO_2$ | Sulfur dioxide |
| TR | Transparency Report [EPD]™ |
| TRACI | Tool for the Reduction and Assessment of Chemical and other environmental Impacts |
| UNCPC | United Nations Central Product Code |

**Modules are identified by terms as follows:**

| | |
|---|---|
| A1 to A3 | Product stage modules |
| A4 to A5 | Construction stage modules |
| B1 to B7 | Use stage modules |
| C1 to C4 | End of life stage modules |
| D | Benefits and loads beyond the system boundary |

# 4. LCA background reports & EPDs

When creating an EPD, an LCA background report must be submitted. This document specifies the standards of LCA calculation rules as a prerequisite of EPDs as well as the requirements of the LCA background report (in conformance to ISO 14025:2006 Clause 6.7.1).

## 4.1 Content, structure, and accessibility of the background report

The background report:

- Represents the systematic and comprehensive summary of project documentation with the objective of supporting the examination of an EPD. The background report must document that the information on which the LCA is based as well as the additional information contained in an EPD conforms to the requirements of this document.
- Must contain all of the data and information of importance for the details published in the EPD and required in this set of rules, including how the reference service life (RSL) was established.
- Must be accessible by the verifier under the conditions of confidentiality (see ISO 14025:2006 Clause 8.3).

The background report is not a component of public communication, but a redacted version will be made available upon request (see Section 4.3 herein).

Numerical data which is required to be reported in the background report and in the EPD shall be reported in SI units.

## 4.2 General information

The background report must contain the following general information:

- The client commissioning the LCA, the name(s) and affiliation(s) of the life cycle assessment practitioner(s), and a company contact
- The report date
- A statement that the LCA was performed in agreement with the requirements of this PCR

## 4.3 Publication

The full background report shall be made available to the reviewer and the verifying party. Furthermore, a third-party report stripped of confidential information shall be provided to the program operator upon request (see [ISO 14044, section 5.2] for guidance on creating third-party reports). The redacted background report will be made available to third parties by the program operator upon request, and the program operator will notify the EPD owner of any distribution of the redacted background report.

## 4.4 Goal of the LCA study

The goal of the LCA study must be outlined in the background report and include:

- Reasons for performing the study
- Intended use
- Target audience (i.e., whether the information and data are intended for business-to-business and/or business-to-consumer communication)

## 4.5 Scope of the study

The scope of the study shall be detailed in the background report.

### 4.5.1 Declared/functional unit

The LCA must be calculated for a declared/functional unit of the product as outlined in Section 7.1 Declared/functional unit herein.

## 4.6 EPD types

In alignment with the Guidance for Determining EPD Types and Calculating and Communicating Data Specificity Through the Supply Chain addendum to the ACLCA PCR Open Standard v1.0, the nomenclature shown in Figure 1 applies when determining one of six EPD types:

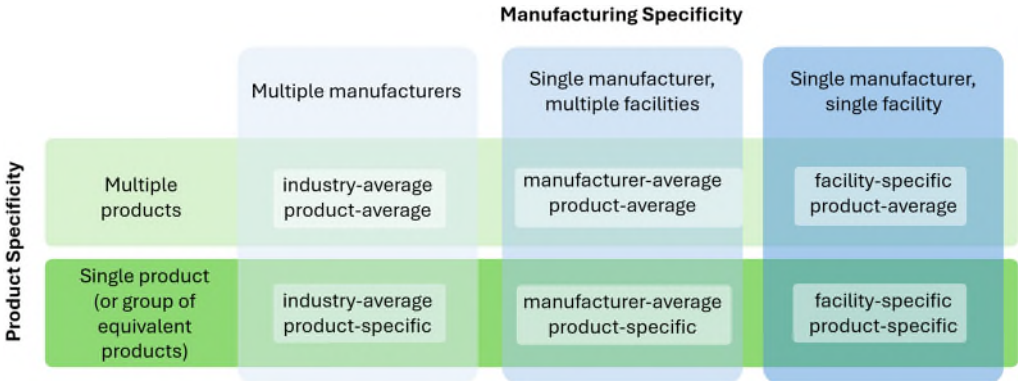


**Figure 1.** Nomenclature for EPD types

Refer to the following definitions when determining EPD type:

- **Industry-average EPD:** An EPD that reports the impacts for a product which is an average of data provided by multiple manufacturers in a clearly defined sector and/or geographical area.
- **Manufacturer-average EPD:** An EPD that covers a product or products from a single manufacturer, and that reports environmental impacts based on an average of data from multiple facility locations for the last facilities in the production chain.

  NOTE: EPDs are likely to have multiple upstream raw material suppliers. The manufacturer-average definition specifically refers to the data in A3 being an average of multiple manufacturing plants.
- **Facility-specific EPD:** An EPD that covers a single manufacturer and a single facility for the last facility in the production chain.

  NOTE: EPDs are likely to have multiple upstream raw material suppliers. The facility-specific definition specifically refers to the data in A3 being representative of a single manufacturing plant.
- **Product-average EPD:** An EPD that covers a group of similar products from one or more sites of one company or multiple companies, or an EPD that groups similar products using averaged environmental performance data across modules A1-A3. Products included in an average EPD should be within ±10% of the mean impact per reported environmental impact category. A product-average EPD shall also include a product description explaining the variation in the composition or performance of the products that the EPD represents.
- **Product-specific EPD:** An EPD that covers a single product. Given that the distinguishing benefit of a product-specific EPD is its accuracy of environmental impact results (by avoiding product-to-product variability), an EPD may also be considered product-specific if it covers a group of similar products

that share equivalent material and performance characteristics such that their environmental impacts per declared unit are sufficiently equivalent.

The specific type of EPD (as determined by Figure 1) and the represented site(s)/plant(s) shall be documented in the LCA background report as well as the EPD.

**Calculation rules for averaging data**

The calculation rules for forming averages in the EPD based on averaged data shall be documented in the background report using one of the following:

- A group of similar products from various manufacturers (the names of the represented manufacturers shall be listed in the EPD)
- The same product from various production locations
- A representative average of the product or a group of comparable products

## 4.7 Product definition

The product to be assessed must be described in terms of its technical and functional specifications, which include:

- Product identification (company logo and product logo and photo(s))
- Product name ID as it is known in the market
- UNCPC (United Nations Central Product Code) classification, CSI (Construction Specifications Institute) MasterFormat® classification, or other applicable industry classification system
- The appropriate product specification from ASTM, ANSI, or other relevant organization, including pertinent physical properties and technical information or any other market identification

Additional attributes can be included as long as they uniquely identify either the product or its potential environmental performance.

EXAMPLE: Product certifications such as GREENGUARD

The product shall be defined by including the following:

- A list of products and other materials that fall within the defined scope of the EPD (in conformance to ISO 14025:2006 Clause 6.7.1)
- Material content: a list of contents larger than 1% by weight (i.e., most dominant), while describing the remainder in aggregate. Materials that exist in the product that are considered proprietary by the manufacturer may be described with a generic descriptor which includes role and/or function. Additionally, where necessary, materials may be reported with a corresponding reasonable range of mass percentages for which they exist in the product or product range.

NOTE 1: Material content aims at material characterization on the level of material types, such concrete, ABS, and brass, but not on the level of chemical content.

NOTE 2: The presence of any hazardous substances showing one or more properties as listed in existing applicable legislation shall be reported and include a description of the regulated substance, the chemical abstracts service (CAS) number, and a reference to standard(s) or regulation(s) applicable for the relevant market.

An example is the identification of substances of very high concern (SVHC) in a publicly available “Candidate List of Substances of Very High Concern for Authorisation of the European Chemicals Agency”. The list is the result of an assessment and evaluation

scheme, which is part of the REACH Regulation (EC) No 1907/2006 (Registration, Evaluation, Authorisation and Restriction of Chemicals). Other examples for consideration are the identification of hazardous substances:

- Listed in the United States Resource Conservation and Recovery Act (RCRA) Subtitle C
- Required to be disclosed on a safety data sheet per the OSHA Hazardous Communication Standard
- Emitted to the atmosphere subject to the requirements of US EPA Clean Air Act including Criteria Air Pollutants and Hazardous Air Pollutants emitted at levels requiring an Air Operating Permit
- Required to be reported by the US EPA toxic release inventory (TRI)
- Required to be disclosed according to US EPA including EPCRA Section 302 Extremely Hazardous Substances (EHSs), CERCLA Hazardous Substances, EPCRA Section 313 Toxic Chemicals, and CAA 112(r) Regulated Chemicals for Accidental Release Prevention

- The following list of specifications per material of the (averaged or most dominant) contents (an example material definition template is shown in Table 1):
    - Origin (extraction location, if known, or at least supplier's location)
    - Supply distance (distance to extraction location in addition to distance to supplier's location, or at least distance to supplier's location)
    - The percentage of recycled content – pre-consumer (optional)
    - The percentage of recycled content – post-consumer (optional)
    - The percentage of renewable resource (optional)

NOTE: Confidential information does not need to be disclosed on the EPD; in such cases, a notation that the information is confidential will be made along with a description of the function of the compound.

**Table 1.** Example material definition template

| Component | Material | Mass % | Availability | | | | Origin of raw materials | Supply distance (km or miles) |
|---|---|---|---|---|---|---|---|---|
| | | | Renewable | Non-renewable | Recycled pre-consumer | Recycled post-consumer | | |
| **Component 1** | Material 1 | X% | yes/no | yes/no | % | % | USA | a |
| | Material 2 | Y% | yes/no | yes/no | % | % | China | b |
| **Component 2** | Material 3 | Z% | yes/no | yes/no | % | % | Germany | c |

## 4.8 Use and/or area of application of the product

- The Part B of the declared product includes nationally accepted standards describing functional performance and can be used to describe the use and/or area of application of the product.
- The use and/or area of application of the declared product must be described in a cradle-to-gate EPD, including functional parameters that are measurable and codified or specified in a commonly accepted national standard.

## 4.9 Depicting the allocation processes in the background report

Uniform application of the allocation rules must be documented in the background report; the following must be described (where relevant):

- Allocations in the use of secondary materials as raw materials
- Allocations in the manufacturing plant(s) (delineation from other products manufactured in the plant)
- Allocation of multi-input processes (if performed during modeling)
- Allocation of reuse, recycling, and energy recovery

The allocation processes selected must be justified. The allocation factors must be plausible and follow LCA best practice.

## 4.10 Depicting the unit processes in the background report

The background report must document modeling of the unit processes in a transparent manner, taking into consideration the ISO 14025:2006 data confidentiality provisions. This can be as a description, in tabular form, or as flow charts (e.g., screenshots from LCA software), whereby the following must be obvious:

- Attribution of company data to data sets from LCA software
- Allocation of process data to the stages of the product's life cycle in the LCA

If several products (different versions of the same product) are declared in a single EPD, or if a product is manufactured at several locations, modeling may be depicted for each product and/or location or depicted for an aggregated set of data. In this case, it is not required to document every data point; reporting averages and/or ranges is sufficient.

## 4.11 EPDs

EPDs are intended to display environmental attributes of products over a cradle-to-gate system boundary and facilitate comparison of the environmental attributes of products that meet equivalent functional requirements over a cradle-to-grave system boundary; these declarations are not comparative assertions. Quantitative data is reported in appropriate and consistent units of measurement as prescribed by Parts A and B of the framework. Qualitative data, where provided, shall be comparable. The same methods or systems should be used to produce the qualitative information, and these methods and systems shall be identified. Details of Part B and the overall Framework are publicly available on the program operator website and can be forwarded to the purchaser or user of the product upon request (see ISO 14025:2006 Clause 7.1).

The EPD content requirements can be found in Appendix C of this document (in conformance to ISO 14025:2006 Clause 7.2).

# 5. General aspects

## 5.1 System boundaries

The system boundaries follow a modular structure in line with ISO 21930:2017 for building and construction products and services, and in conformance to ISO 14025:2006 Clause 5.4 and Clause 7.2.5 for all other products. The environmental information of an EPD covering all life cycle stages (cradle to grave) shall be subdivided into the information module groups defined as A1-A3, A4-A5, B1-B5, B6-B7, C1-C4 and optionally D (Table 2). Information modules include impacts and aspects related to losses in the module in which the losses occur (i.e., production, transport, and waste processing and disposal of the lost waste products and materials).

When a specific individual module (e.g., B2) and/or a specific group module (e.g., B6-B7) are not declared, their corresponding fields in the table (Table 2) must be marked as 'MND' which stands for module not declared.

A graphical depiction or a flow diagram illustrating main production processes pursuant to the defined scope of the LCA is considered to be a part of the background report, which is not accessible to the public.

There are three major scope types of the EPD as illustrated in Table 2 (in conformance to ISO 14025:2006 Clause 5.8). A Part B may specify one or more of these options for EPDs:

- Cradle-to-gate: only includes the A1-A3 module;
- Cradle-to-grave: includes all of the product stage modules, A1 through C4, where module D may be included; or
- Cradle-to-gate with options:
    - Cradle to construction/installation site: includes the A1-A3 module plus transportation to the construction/installation site (A4), based on a declared unit
    - Cradle to installation: includes the A1-A3 module plus both transportation to the construction/installation site (A4) and any construction/installation occurring on site (A5), based on a declared unit
    - Cradle to gate and maintenance: includes the A1-A3 module plus maintenance processes of the product during its service life (B2), based on a declared unit or a functional unit
    - Cradle to gate and end-of-life: includes the A1-A3 module plus any of the relevant end-of-life modules (C1, C2, C3, and/or C4), based on a declared unit; information modules C1 to C4 shall be declared when module D is declared

**Table 2.** System boundary options (only one row to be filled: X = a declared module; MND = module not declared)

| | Product assessment information | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Product life cycle information | | | | | | | | | | | | | | | Supplementary information (benefits and loads) beyond the product life cycle |
| **EPD aggregated modules** | **Production** | | | **Construction/ installation** | | **Use** | | | | | | | **End of life** | | | | **Recovery** |
| | **A1** | **A2** | **A3** | **A4** | **A5** | **B1** | **B2** | **B3** | **B4** | **B5** | **B6** | **B7** | **C1** | **C2** | **C3** | **C4** | **D** |
| **EPD system boundary** | Raw Materials | Transport | Manufacturing | Transport | Installation | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | Deconstruction demolition | Transport | Waste processing | Disposal | Reuse- Recovery- Recycling- potential |
| **Cradle-to-gate** Declared unit | X | X | X | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| **Cradle-to-gate with options** Declared / functional unit | X | X | X | Optional | Optional | Optional | Optional | Optional | Optional | Optional | Optional | Optional | Optional | Optional | Optional | Optional | Optional |
| **Cradle-to-grave** Functional unit | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | Optional |

## 5.2 Comparability limitations

EPDs are not comparative assertions; that is, no claim of environmental superiority can be inferred or implied. EPDs enable purchasers and users to compare the potential environmental performance of products on a life cycle basis. They are designed to present information transparently to make the limitations of comparability more understandable. EPDs of products that conform to the same product group definition (Part B) and include the same life cycle stages, but are made by different manufacturers, may not sufficiently align to support direct comparisons. They therefore cannot be used as comparative assertions unless the conditions as defined in ISO 14025:2006 Clause 6.7.2. 'Requirements for comparability' are satisfied.

Additionally, for building and construction products and services, comparisons using an EPD shall be carried out in the context of the construction works per the requirements in ISO 21930:2017 section 5.5.

## 5.3 Updating the EPD

The EPD verification is valid for five years. An organization may need to correct or amend information included in EPDs. EPDs shall be reassessed and updated as necessary to reflect changes in technology

or other circumstances when they cause a change in the results by ±10% or alter the content and accuracy of the declaration. When updating a TR/EPD, the same reviewers should provide re-verification. The organization making the EPD is responsible for notifying the program operator of the requested changes in the EPD and supplying the program operator with a document from the verifier confirming conformance to relevant requirements.

# 6. Life cycle stages

This section describes the information modules for each life cycle stage. Information modules include impacts and aspects related to losses in the module in which the losses occur (i.e., production, transport, and waste processing and disposal of the lost waste products and materials). Information modules are communicated depending on the system boundary, as explained in section 5.1.

If no activity is expected in an information module, then the scenario and assessment of the module should reflect this rather than declaring the module not relevant or not applicable for a cradle-to-grave EPD. Part B should define default scenarios for all the information modules A4, A5, B1 to B7, and C1 to C4, if it is intended to be used for a cradle-to-grave EPD. Any mandatory information modules shall have the scenarios defined. EPDs declaring information modules with scenarios not defined in the PCR shall clearly state the scenario within the EPD.

This document applies to all product categories; however, the examples shown in this section are specific to building and construction products and services.

## 6.1 A1-A3: Product stage

The product stage is an information module that is always included in the EPD. The system boundary shall include all processes that provide material and energy inputs into the system and the following manufacturing and transport processes of products up to the factory gate, as well as the processing of any waste arising from those processes.

The product stage includes the following information modules:
- A1: Raw material extraction and upstream production/processing, processing of secondary material input (e.g., recycling processes)
- A2: Transport to the manufacturer/factory
- A3: Manufacturing

Modules A1, A2, and A3 may be declared as an aggregated Module A1-A3 unless specifically prohibited in an associated Part B PCR.

The product stage includes, where relevant, information modules for:
- A1: Extraction and processing of raw materials (e.g., mining processes) and biomass production and processing (e.g., agricultural or forestry operations), including the production of inputs where they are used
- A1: Reuse of products or materials from a previous product system
- A1: Processing of secondary materials used as input for manufacturing the product, but not including those processes that are part of the waste processing in the previous product system
- A1: Generation of electricity, steam, and heat from primary energy resources used for extraction and processing of raw materials, including extraction, refining, and transport thereof
- A1: Generation of electricity, steam, and heat from secondary fuels, but not including those processes that are part of waste processing in the previous product system to recover secondary fuels
- A1: Energy recovery and other recovery processes from secondary fuels, but not including those processes that are part of waste processing in the previous product system

- A1: Waste management from manufacturing packaging and manufacturing wastage including transport up to the recycler or disposal
- A2: Transportation up to the factory gate in addition to internal transport
- A3: Production of ancillary materials
- A3: Generation of electricity, steam, and heat from primary energy resources used in manufacturing, including their extraction, refining, and transportation
- A3: Energy recovery and other recovery processes from secondary fuels, but not including those processes that are part of waste processing in the previous product system
- A3: Emissions from the combustion of secondary fuels and waste used in the manufacturing process
- A3: Manufacturing of products and co-products, including their extraction, manufacturing, and transportation
- A3: Manufacturing of primary packaging (i.e., the first layer of packaging that directly encloses the product), including their extraction, manufacturing, and transportation
- A3: Waste management from manufacturing packaging and manufacturing wastage including transport up to the recycler or disposal.

The flows reaching the system at the A1-A3 boundary are determined as follows:

- Production waste whose materials are *internally recycled* can be considered as recycled within Modules A1-A3 to the maximum volume used in production. A co-product allocation is necessary for production waste exceeding the volumes (of on-site closed-loop recycling) used in Modules A1-A3.
- Co-product allocation is necessary for production waste whose materials are *reused* (i.e., open-loop recycling).
- Heat and power from energy recovery of production waste in Modules A1-A3 can be considered closed-loop within Module A1-A3 if they are used at the same quality within Modules A1-A3 and only to the maximum amount in MJ as is required of the respective energy quality in MJ during production (assumption: overall manufacturing, A1-A3, considered as a module). A co-product allocation is necessary for energy surpluses exceeding the volumes considered closed-loop.

The following allocation rules shall apply:

1. Regardless of the geographical coverage of a product system, the rules for defining the system boundaries between product systems apply.
2. The output of waste during this life cycle stage may become a useable output flow, such as a secondary material/fuel or recovered energy, when it has been through a recovery process and complies with the conditions described in the system boundary between product systems. These usable output flows shall not be considered as co-products but shall be considered waste and no allocation to secondary material, secondary fuels or recovered energy shall be permitted. As an option, the potential loads and benefits from the net usable output flows from recovery processes may be considered as supplementary information in module D.
3. In the case of input of secondary materials or energy recovered from secondary fuels, the system boundary between the system under study and the previous system (providing the secondary materials) is set where outputs of the previous system (e.g., materials, products, or energy or building elements) reach the system boundary between product systems.
4. If an allocation procedure different from co-product allocation is chosen for flows that reach the system at the boundary A1-A3 or data sets are chosen where allocation procedures are unknown, this procedure has to be justified and documented. Data sets with clear allocation procedures are

preferred to be the first choice. The resulting material and energy flows and their amounts/volumes within Module A1-A3 are to be described transparently in the background report.

5. Loads and benefits from allocated co-products shall not be declared in the optional Module D. If such a co-product allocation is not possible, other methods may be chosen and shall be justified and documented. Therefore, as a general rule, potential loads or benefits from A1-A3 will not appear in Module D.

## 6.2 A4-A5: Construction/Installation stage

The construction and/or installation stage information module shall include all processes that provide materials, products, and energy, as well as waste processing up to the system boundary between product systems or disposal of final residues during this stage. These information modules also include all impacts and aspects related to any losses during this construction and/or installation process stage (i.e., production, transport, and waste processing and disposal of the waste-losses of products and materials).

The construction and/or installation process stage includes the following information modules:
- A4: Transport/Delivery to the intermediate storage site, if relevant, and to the site where the product is installed, used, and/or constructed
- A4: Storage of products, including the provision of heating, cooling, humidity control, etc.
- A5: Waste of products (including additional production processes required to compensate for the loss of waste of products)
- A5: Waste processing of the waste from product packaging and product waste during the construction and/or installation process up to the system boundary between product systems or disposal of final residues
- A5: Installation of the product including manufacture and transportation of ancillary materials and any direct use of energy or consumption of freshwater required for installation at the installation site
- A5: Installation-specific site preparation for the declared product including ancillary materials and waste management if relevant

Packaging waste assumptions:
- Packaging waste management methods for packaging waste produced in the US are assumed to follow the latest version of EPA's Sustainable Materials Management Fact sheet, which provides a breakdown for common packaging materials. These values shall be used for US-based processes when primary data or other secondary data are not available: https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/advancing-sustainable-materials-management

In the case of a product sold as a system, then:
1. The production of all materials and components needed in A5 are to be declared in A1-A3 (e.g., packaging).
2. The transport of the system to the construction/installation site is to be declared in A4. The installation, waste treatment inclusive, shall be declared in A5.

The following applies to information module A5:
1. In case energy recovery is chosen as a part of a scenario:
    - If no specific information for the recovery efficiency of the incineration plant is available, it shall be assumed for North American standards (with proper documentation and justification) that packaging material and eventual product waste from the installation process is treated thermally in a plant with less than 60% recovery. Thus, the combustion process (loads) for the packaging waste and product waste from the installation process is to be declared in module A5, while the resulting benefits are to be optionally declared in module D.

2. The information module A5 shall include manufacturing and transportation of ancillary materials in addition to any energy or water required for either the product installation (including any on-site operations to the product) or operation of the construction/installation site, or both.

## 6.3 B1-B5: Use stage information modules

The use stage information modules include all processes and transportation of all materials, products, and related energy or water use, as well as waste processing up to the system boundary between product systems or disposal of final residues during the use stage. These information modules also include all impacts and aspects related to the losses during the use stage (i.e., production, transport, and waste processing and disposal of the lost products and materials).

The use stage information modules include the information modules covering the period from the sale / procurement or handover of the product, construction and/or installation work until it is uninstalled, dismantled, deconstructed, or demolished (see example below). The use stage information modules also include the use of products, equipment, and services in their proper function in addition to their use (see example below). Moreover, the use stage information modules include individual modules that cover maintenance (including cleaning), repair, replacement, and refurbishment.

NOTE: The duration of the use stage of products may not be the same as the reference service life.

EXAMPLE: For a building this would include protecting, conserving, moderating, or controlling a building (e.g., modules describing the building operation through services such as heating, cooling, lighting, water supply, and internal transport such as lifts and escalators).

While it is recognized that it may be difficult to separate all use stage processes and the associated aspects and impacts into these individual modules, any deviation from the categorization of aspects and impacts into Modules B1-B5 and B6-B7 shall be transparently reported and justified.

The use stage includes the following information modules:
- B1: Normal (i.e., anticipated) use of the product
- B2: Maintenance
- B3: Repair
- B4: Replacement
- B5: Refurbishment

### 6.3.1 B1: Normal (i.e., anticipated) use of the product

Module B1 ‘Normal (i.e., anticipated) use the product’ covers environmental aspects and impacts arising from activities throughout the normal anticipated use of the product.

Information Module B1 covers any relevant activities that are not covered by B2-B7 information modules (e.g., release of substances from the façade, roof, floor covering, and other interior or exterior surfaces to indoor air, soil, or water).

NOTE: The LCA background report and consequently the EPD do not need to include this information (i.e., emissions to indoor air, soil, and water during the use stage) if standards on measurement of release of regulated dangerous substances from products using

harmonized test methods according to North American or European product standards are not available.

### 6.3.2 B2: Maintenance

Module B2 ‘Maintenance’ covers all planned technical services (e.g., work done on the product to replace worn, damaged, or degraded parts) and associated administrative operations during the reference service life to maintain the product installed in a state in which it can perform its required functional and technical performance, as well as preserve its aesthetic qualities. This includes any and all preventative and regular maintenance activities such as cleaning and the planned technical service, replacement of worn, damaged, or degraded parts. Water and energy usage required for cleaning shall be included in this module.

EXAMPLE: Painting work on window frames, doors, etc. as well as the annual inspection and maintenance of the (oil or gas) boiler and replacement of filters in the heat recovery or air conditioning system

The boundary of Module B2 shall also include the following:
- The production and transportation of any component and ancillary products used for maintenance, including cleaning
- Transport of any waste from maintenance processes or from maintenance-related processes
- The end-of-life processes of any waste from transportation and the maintenance processes, including the removal of any part of the component and ancillary materials

NOTE: Module B2 would not cover maintenance, repair, and/or replacement during refurbishment activities. For example, for building products, B2 would not cover the maintenance, repair, and/or replacement of a whole section of the building where the product is installed if these activities are part of a complete measure of the building. The same would be considered refurbishment and shall be included in Module B5.

### 6.3.3 B3: Repair

If known or relevant, module B3 ‘Repair’ covers all technical services (e.g., construction and/or installation work) and associated administrative operations during the reference service life in the form of corrective, responsive, or reactive actions of a product or its parts installed in order to return it to an acceptable condition in which it can perform its required functional and technical performance as well as preserve its aesthetical qualities.

Replacement of a broken component or a part due to damage should be assigned to ‘repair’, whereas replacement of a whole product due to damage should be assigned to Module B4.

The boundary of Module B3 shall also include the following, if known or relevant:
- Repair processes including:
    - the production of the repaired part of a component and of related used ancillary materials
    - energy and water usage during the repair process
    - the production and transport aspects and impacts of any material’s waste during the repair processes
- The transportation of the repaired components and of used ancillary materials, including production aspects and impacts of any damaged materials during transportation

- The end-of-life processes of any losses suffered during transportation and the repair process, including the removal of the repaired parts of the component as well as ancillary materials

EXAMPLE: For a window with damaged rubbers, this includes the production and transportation of new rubber as well as packaging, in addition to all impacts due to the repair process and the end-of-life stage of the rubber waste and packaging.

### 6.3.4 B4: Replacement

If known or relevant, module B4 ‘Replacement’ covers all technical services and associated administrative operations during the reference service life associated with replacing a whole product in order to return product to a condition in which it can perform its required functional or technical performance.

The replacement of a broken component or part due to damage is considered repair and should be included in individual module B3, as fully discussed above. However, the replacement of a whole product due to damage should be considered replacement and should be included in individual module B4. The replacement of a whole element as part of a concerted replacement program is considered refurbishment and should be included in individual module B5. For example, for building products, the replacement of a whole element as part of a remodel is considered refurbishment and should be included in B5.

The boundary of Module B4 shall also include the following, if known or relevant:
- Replacement processes including:
    - the production of the replaced components and of related used ancillary materials
    - energy and water usage during the replacement process
    - the production and transport aspects and impacts of any material’s waste during the replacement processes
- The transportation of the replaced components and of used ancillary materials, including production aspects and impacts of any damaged materials during transportation
- The end-of-life processes of any losses suffered during transportation and the replacement process, including the removal of replaced components as well as ancillary materials

EXAMPLE: A module B4 of a carpet being replaced at the end of its service life would include:
1. The production and transportation of the new carpet as well as packaging
2. All impacts due to the installation process (adhesive, vacuum cleaning, etc.)
3. Any waste from the installation of the replacement carpet, packaging waste, and adhesive
4. The end-of-life stage of the original carpet

### 6.3.5 B5: Refurbishment

Module B5 ‘Refurbishment’ covers all technical services and associated administrative operations during the service life of a product associated with the return of the products or its parts to a condition in which the products can perform its required functions. These activities cover a concerted program of maintenance, repair, and/or replacement activity, across a significant part or a whole section of the area where the product is installed. All similar restoration activities should be included within module B5.

The boundary of Module B5 shall also include the following:
- Refurbishment processes including:
    - The production of the components and of related used ancillary materials
    - Energy and water usage during the refurbishment process
    - The production and transport aspects and impacts of any material's waste during the refurbishment processes
- The transportation of the refurbished components and of used ancillary materials, including production aspects and impacts of any damaged materials during transportation
- The end-of-life processes of any losses suffered during transportation and the refurbishment process, including the removal of components as well as ancillary materials

## 6.4 B6-B7: Operational energy and water use

The use stage related to the operation of the product includes:
- B6: Operational energy use
- B7: Operational water use

These information modules include provision and transport of all materials, products, as well as energy and water provisions, waste processing up to the system boundary between product systems, or disposal of final residues during this part of the use stage which enable the accounted operational energy and water use.

EXAMPLE: Aspects related to the production, transportation, and installation of technical equipment (such as building automation and control systems) required for supplying energy and water to the building shall be assigned to Modules A1-A5. Energy and water use during maintenance, repair, and replacement or refurbishment activities shall be assigned to Modules B2-B5. Aspects related to the waste processing and final disposal of materials shall be assigned to Modules C1-C4.

NOTE: Building automation and control systems are centralized, interlinked networks of hardware and software which manage various building systems while ensuring optimal operational performance of mechanical, electrical, and plumbing systems such as HVAC systems, power monitoring, plumbing and water monitoring, security, closed-circuit television, fire alarm system, elevators and escalators, etc.

### 6.4.1 B6: Operational energy use

The boundary of module B6 'Operational energy use' includes energy use during the operation of the product and its associated environmental aspects and potential impacts, including processing and transportation of any waste generated on site due to the use of energy.

NOTE 1: For building and construction product and service EPDs aimed to North American market: guidance on the selection of standards for calculating operational energy use of technical building systems can be obtained from ASHRAE Level I – III Procedures for Commercial Building Energy Audits (PCBEA), Second Edition.

NOTE 2: For building and construction product and service EPDs aimed to European market: guidance on the selection of standards for calculating operational energy use of technical building systems can be obtained from CEN/TR 15615, Explanation of the general

relationship between various European standards and the Energy Performance of Buildings Directive (EPBD) – Umbrella Document.

### 6.4.2 B7: Operational water use

Module B7 ‘Operational water use’ includes water use during the operation of the product and its associated environmental aspects and potential impacts considering the life cycle of water, which includes production, transportation, and wastewater treatment.

## 6.5 C1-C4: End-of-life stage information modules

The end-of-life stage of the product starts when it is replaced (see B4), dismantled, or deconstructed from the construction and/or installation works and does not provide its initial functionality, including provision and transport of all materials and associated energy and water use. However, the system boundary between the product system and optional module D, which is not a part of the studied product system, is set at the system boundary between the studied product system and any subsequent product systems.

Loads (e.g., emissions) from waste disposal in Module C4 are considered part of the product system under study, according to the “polluter pays principle.” If, however, this process generates energy such as heat and power from waste incineration or landfill, the potential benefits from utilization of such energy in the next product system may optionally be included and assigned to Module D and are calculated using current average substitution processes.

The end-of-life stage includes:
- C1: Un-installation, deconstruction, and demolition
- C2: Transport to waste processing or disposal
- C3: Waste processing, including for reuse, recovery and/or recycling
- C4: Disposal of waste

The end-of-life stage may also include optional information modules, where applicable, for:
- C1: Deconstruction which includes the dismantling or the demolition of the product from the area of construction and/or installation and the energy use for this, as well as the initial on-site sorting of the materials, if applicable
- C2: Transportation of the discarded product to waste processing either to a recycling site or to final disposal
- C3: Waste processing, which includes, for example collection of waste fractions from the deconstruction, recovery, and waste processing of material flows resulting in materials for reuse, secondary materials, secondary fuels, or export of recovered energy from the energy recovery from waste with an efficiency of energy recovery of at least 60%, without prejudice to existing legislation.
- C4: Waste disposal which includes physical pre-treatment and management of the disposal site, including provision and transport of all materials, products, and related energy and water use

During the end-of-life stage of the product and its application, all outputs from the following are, at first, considered as waste:
- uninstallation, dismantling, deconstruction, or demolition of the product (or area of construction and/or installation)
- maintenance (see B2), repair (see B3), replacement (see B4), or refurbishing (see B5) processes
- products, debris, materials, or elements, etc.

This output, however, reaches the system boundary between product systems only when it conforms to all of the following criteria:

1. the recovered material, product or construction element is commonly used for specific purposes such as the function of a certain product as well as the assignment of a material as an input to the production process of another product or energy generation process
2. a market or demand, identified by a positive economic value, exists for such a recovered material, product, or construction element
3. the recovered material, product, or construction element fulfils the technical requirements for the specific purposes and meets the existing legislations and standards applicable to products
4. the use of the recovered material, product, or construction element will not lead to overall adverse environmental or human health impacts

The criterion for "*overall adverse environmental or human health impacts*" shall refer to the limit values for pollutants set by regulations in place at the time of assessment and where necessary shall take into account adverse environmental effects. The presence of any hazardous substances exceeding these limits in the waste or showing one or more properties as listed in existing applicable legislation (e.g., the United States Resource Conservation and Recovery Act) prevents the waste from reaching the system boundary between product systems.

In principle, waste processing is part of the product system under study. In the case of materials leaving the system as secondary materials or fuels, processes such as collection and transport before the system boundary between product systems is reached are, as a rule, part of the waste processing of the product system under study (see C3). However, after having reached the system boundary between product systems, further processing may also be necessary in order to replace primary materials or fuel input in another product system. Such processes are considered to be beyond the system boundaries and may be assigned to the optional module D. Secondary materials having left the system may be optionally declared as substituting primary production in module D, only if they have reached the functional equivalence of the substituted primary materials.

## 6.6 D: Benefits and loads beyond the system boundary information module

Reporting module D is optional. Module D aims at transparently reporting and declaring the potential environmental benefits or loads resulting from net flows of reusable products, recyclable materials, and/or useful energy carriers leaving a product system (e.g., as secondary materials or fuels) only if they have not been allocated as co-products and have also passed beyond the system boundary of the studied product system. Avoided impacts from allocated co-products shall not be included in module D.

The net impacts are calculated as follows:

- By identifying the point of substituted functional equivalence where the secondary material or fuel or recovered energy substitutes primary production
- By adding all output flows of a secondary material or fuel and subtracting all input flows of this secondary material or fuel from each sub-module first (e.g., B1-B5, C1-C4, etc.), then from the modules (e.g., B, C), and finally from the total product system thus arriving at net output flows of secondary material or fuel from the product system
- By adding the impacts connected to the recycling or recovery processes from beyond the system boundary (beyond the system boundary of the studied product system) up to the point of functional equivalence where the secondary material or energy substitutes primary production and subtracting the impacts resulting from the substituted production of the product or substituted generation of energy from primary sources

- By applying a justified value-correction factor to reflect the difference in functional equivalence where the output flow does not reach the functional equivalence of the substituting process

Module D includes reuse, recovery, and/or recycling potentials of products and materials expressed as net impacts and benefits. The information in Module D may also contain technical information, parameters describing potential environmental impact and resource use, and other environmental information describing different waste categories and output flows.

# 7. Calculation rules for the LCA

## 7.1 Declared/functional unit

The results of the LCA must be calculated per a declared/functional unit of the product as specified in Part B.

Usually, the declared unit refers to a product with a cradle-to-gate scope. If a system sold by a manufacturer is declared, the declared unit may also refer to the product "as installed" (also see Section 6.2 “A4-A5: Construction/Installation Stage” herein).

The functional unit is used when the scope is cradle-to-grave (i.e., A1-C4; optionally module D). When the entire life cycle is declared, the reference service life (RSL) shall be indicated (see Section 7.2 herein).

The declared or functional unit shall be reported in its entirety (i.e., no percentages are allowed) as specified in Part B. Standard units can be declared (e.g., 1 $m^2$ of a defined thickness and density), whereby conversion to the declared or functional unit is clear. In this case, a statement must be included in the LCA background report detailing the conversion.

The mass of the declared unit shall be indicated.

## 7.2 Documentation for reference service life (RSL) and estimated service life (ESL) calculations

Information on the product’s RSL requires specification of compatible scenarios for the product stage, construction and/or installation process stage, and use stage. The RSL is dependent on the properties of the product and the reference in-use conditions. These conditions shall be declared together with the RSL, and it shall be stated that the RSL applies for the referenced in-use conditions only.

RSL information declared in an EPD covering the use stage shall be provided by the manufacturer. The RSL shall refer to the declared technical and functional performance of the product. It shall be established in accordance with any specific rules given in the specific regional product standards.

For building and construction products and services, the RSL shall be considered in conjunction with the building’s estimated service life (ESL) to facilitate use stage calculations. The default ESL is 75 years, based on ASHRAE 189.1-2023 (see section 9.5/11.2.b) that serves as the complete technical content of the International Green Construction Code 2018 (IgCC) (see section 901.5.2).

The number of replacements in B4 for the duration of the ESL shall be rounded up to the nearest tenth of a product and can be calculated as follows:

$$Number\ of\ replacements = \frac{ESL}{RSL} - 1$$

In the case where the RSL is greater than the ESL, results shall be reported for an RSL equal to the ESL.

## 7.3 Description of the system boundary in the background report

The description of the system boundary in the background report includes the following elements:

1. Description of an analysis period for each of the modules considered in the LCA; presenting the same using a flow chart is preferred
2. List of omissions of life cycle phases, processes, or data needs
3. Assumptions in regards to power generation, including reference to studied year or period
4. Assumptions in regards to other relevant background data (see also section 7.5 “Selecting data / background data” below) impacting the description of the system boundary

## 7.4 Criteria for the exclusion of inputs and outputs (cut-off rules)

The criteria for the exclusion of inputs and outputs (i.e., cut-off rules) in the LCA and information modules and any additional information are intended to support an efficient calculation procedure. Cut-off rules shall not be applied in order to hide data. Therefore, any application of the criteria for the exclusion of inputs and outputs shall be transparently documented in the background report. When impacts are assessed and reported, the cut-off rules shall be based on the environmental impacts related to the respective material flows. The cut-off rules shall be justified and documented, as well as a list of processes not taken into consideration (in conformance to ISO 14025:2006 Clause 9.2.1). A statement on any omissions shall be included in the background report.

The following procedure shall be followed for the exclusion of inputs and outputs:

- All inputs and outputs to a unit process shall be included in the calculations of the pre-set parameters results, for which data are available. Data gaps shall be filled by conservative assumptions with average, generic, or proxy data. Any assumptions for such choices shall be documented.
- Particular care should be taken to include material and energy flows that are known or suspected to release substances into the air, water, or soil in quantities that contribute significantly to any of the pre-set indicators of this document. In cases of insufficient input data or data gaps for a unit process, the cut-off criteria shall be 1% of renewable and non-renewable primary energy usage, 1% of the total mass of that unit process, and 1% of potential environmental impacts. The total neglected input flows per module group, (i.e., A1-A3, A4-A5, B1-B5, B6-B7, C1-C4 and D) shall be a maximum of 5%. Conservative assumptions combined with plausibility considerations and expert judgment can be used to demonstrate conformance to these criteria and the same shall be documented.
- All substances with hazardous and toxic properties that can be of concern for human health and/or the environment shall be identified and declared according to normative requirements in standards or regulation applicable in the market for which the EPD is valid, even though the given process unit is under the cut-off criterion of 1% of the total mass. If no such materials are present, a statement shall be added to the EPD to attest.

## 7.5 Selecting data / background data

The following rules shall apply for data selection:

1. As a general rule, either specific data or average data derived from specific production processes shall be the first choice of data used in the calculations of an EPD.
2. An EPD describing an average product shall be calculated using representative average data of the products declared.
3. An EPD describing a specific product shall be calculated using specific data for at least the processes on which the producer of the product has control over. Generic and proxy data may be used for the processes which the producer does not control, often referred to as upstream data (e.g., processes dealing with the production of input commodities such as raw material extraction or electricity generation).

4. A specific EPD covering all life cycle stages (i.e., cradle to grave) may be calculated using generic and proxy data for some downstream processes (e.g., waste incineration). For the sake of comparability, the calculation of the use stage shall be based on the same additional technical information as required in this document.
5. The additional technical information for the development of scenarios shall be specific or average (when an average product is declared).
6. Documentation of technological, geographical, and time related representativeness for generic data shall be provided in the background report.

NOTE: Publicly available generic data, which may be average or specific, describe “upstream” and “downstream” processes.

## 7.6 Data / Background data quality requirements

In conformance to ISO 14025:2006 Clause 6.7.1, this document contains the list of the requirements of data/background data quality which includes coverage, precision, completeness, representativeness, consistency, reproducibility, sources, and uncertainty. The quality of the data used to calculate the EPD shall be addressed in the background report (see ISO 14044:2006, 4.2.3.6). In addition, the following specific requirements shall apply for products:

- Generic data sets used for calculations shall have been updated within the last 10 years (the inventory shall have been updated, not necessarily the underlying reference data). Producer-specific data sets shall have been updated within the last 5 years. Deviations shall be justified.
- Primary data shall be collected for every process in the product system under the control of the organization(s) developing the LCA. In addition, data specific to the investigated product scope and supply chain are preferable to generic data, particularly in unit processes considered to have a significant contribution to the product life cycle. The method of data collection shall be specified (e.g., measured, calculated, estimated). If the specified data collection means are unachievable, the EPD developer shall record the data collection method(s) utilized in the data description. Manufacturer-specific data sets shall be based on average data from 12 consecutive months; deviations shall be justified in the LCA report. The base year needs to be reported in both the background report and the EPD. If future production conditions are to be incorporated at the time of generating the EPD, the following shall apply:
    - Processes which do not have an influence on the manufacturing process (e.g., procurement of green electricity) can be integrated in the results. For green electricity, this means that the EPD may not be issued until such a time as procurement takes place and is verified by the presence of a contract.
    - For processes which have an influence on the manufacturing process (e.g., new furnace), data must be available over a certain period of time which provides a representative set of data for the new process (a period of 3-4 months often suffices in such cases).
- The time period over which inputs to and outputs from the system shall be accounted for is 100 years from the year for which the data set is deemed representative. A longer time period shall be used if relevant as indicated in Part B.
- The technological coverage shall reflect the physical reality of the declared product or product group.
- Generic data shall be checked for plausibility.
- Data sets shall be complete according to the system boundaries and criteria for the exclusion of inputs and outputs as outlined in this document.
- Uncertainty shall be addressed in the data quality assessment and may be addressed qualitatively or quantitatively. The PCR committee may specify in each Part B the type of uncertainty analysis to be performed in the background LCA.

Until pre-verified generic data sets are available nationally or internationally and referenced to in the background report, the following rules shall apply for selecting the background database:

- As a general rule, choices of background data sets must be made consistently ensure comparability of results.
- The choices must be plausible.

EXAMPLE: GaBi databases as well as US-ecoinvent and the USLCI databases are examples of generally accepted databases in the North American market.

The background report must:

- Indicate the data sets used, including their source (e.g., name of database, literary source), the full name of the data set, and the year for which the data set is representative.
- Document the representativeness of data sets used
- Document the treatment of missing data (as outlined in this document)
- Evaluate the data quality (in general or using a pedigree matrix or similar)

## 7.7 Power mix

The following applies in regards to selecting the power mix used to calculate impacts from electricity used during production that is not covered by contractual instruments:

- For manufacturing facilities located in the USA, the electricity grid mix used to model electricity consumed at each included facility shall be based on the EPA eGRID[2] subregion or balancing authority area for that facility.
- For manufacturing facilities located in Canada, the electricity grid mix used to model electricity consumed at each included facility shall be based on province-level data from StatCan[3].
- For manufacturing facilities located in China, the electricity grid mix used to model electricity consumed at each included facility shall be based on regional grid mixes published by the China National Bureau of Statistics[4].
- For manufacturing facilities outside of the USA, Canada, or China, country-specific electricity grid mixes shall be based on IEA[5] and/or OECD[6] statistics.
- The electricity grid mix used shall temporally correspond to the period of data collected from the facilities, or the latest available grid mix data. The most recent mixes as implemented in commonly available databases may be used.
- National averages are also allowed for group averages or associations; however, the sensitivity of the results shall be checked using combined weights by production volumes. If such regional data are not available, production mixes may be used instead of the national average in cases where the national average is not representative.

## 7.8 Quantifying renewable electricity instruments

Product-level LCAs that incorporate renewable electricity, through mechanisms such as Renewable Electricity Certificates (RECs) or Power Purchasing Agreements (PPAs), shall conform to the 2023 Quantifying Renewable Electricity Instruments in Environmental Product Declarations (EPDs) addendum

[2] US Environmental Protection Agency. Emissions & Generation Resource Integrated Database (eGRID). https://www.epa.gov/egrid
[3] Statistics Canada. https://www.statcan.gc.ca/en/start
[4] China National Bureau of Statistics Database. https://data.stats.gov.cn/english/adv.htm?m=advquery&cn:=E0101, with transmission and distribution loss information from: https://chinaenergyportal.org
[5] IEA. World Energy Balances. https://www.iea.org/data-and-statistics/data-product/world-energy-balances
[6] OECD iLibrary. IEA World Energy Statistics and Balances. https://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en

to the ACLCA PCR Open Standard. Upon publication of an updated version of this addendum, Sustainable Minds will review the update and consider incorporation into Part A.

As of the Part A v4.0 update, there is no widely accepted guidance on incorporating market-based mechanisms for thermal energy, such as renewable thermal certificates (RTCs). RTCs and other market-based mechanisms for thermal energy shall not be used in EPDs using this PCR.

NOTE: This requirement may be adjusted in the future if guidance or standards on incorporating RTCs into EPDs become available.

## 7.9 Transportation

Weighted average primary data based on sales shall be used to calculate transportation impacts, if available. Where primary data is not available, the transport distances listed by commodity in the Commodity Flow Survey Datasets[7] may be used to establish transportation distances.

The following methods and assumptions shall be used to calculate transportation and distribution impacts for the final product.

Land transport

Include land transport from the manufacturing facility to the nearest or most likely port of departure, if applicable. Also include land transport within the destination country. Assume land transport is completed with a truck unless primary data is available to justify rail travel. If distance-based calculations are used, use commonly available mapping software.

Sea transport

If applicable, include sea transport from the port of departure to the port of arrival using the shortest feasible distance (SFD) from the Centre d'Études et de Recherches sur le Dévelopment International (CERDI) Sea Distance Database[8].

Air transport

If applicable, include air transport using the great circle distance approach described in the latest version of the International Civil Aviation Organization (ICAO) carbon calculator methodology document[9], including the suggested additional distance based on the length of the flight.

Waste transportation

For waste produced in the US, the EPA WARM model provides an average end-of-life transportation distance of 20 mi. This value shall be used for US-based processes when primary data or other secondary data are not available, and when the transportation distance is not integrated into the data set. Outside of the US, other appropriate regional or national assumptions may be used. The type of vehicle modeled shall be an average refuse truck.

## 7.10 Developing product level scenarios

With the exception of the required Modules A1 to A3, which describe the manufacturing stage of a product and are therefore already known, specific primary data for modules B and C are not commonly available. Where specific or average data is not available to use in modules B and C, scenarios shall support the calculations of information modules covering processes related to the environmental assessment of the remaining life cycle stage(s) of the product and shall support the potential

[7] US DOT Bureau of Transportation Statistics and US Department of Commerce, U.S. Census Bureau. Commodity Flow Survey Datasets. https://www.census.gov/programs-surveys/cfs/data/datasets.html
[8] CERDI Sea Distance Database. https://ferdi.fr/en/indicators/the-cerdi-seadistance-database
[9] International Civil Aviation Organization. Cabon Emissions Calculator. https://applications.icao.int/icec.

environmental performance assessment of the product in its life cycle stages (construction and/or installation, use stage, and end life). Where reasonable scenarios for the specific stages can be modeled, those stages shall not be excluded. Assumptions made to create the scenarios are documented in Part B (see ISO 14025:2006 Clause 9.2.1).

Scenarios assist in the derivation of predetermined parameters of the EPD following the calculation rules outlined in this document. Consequently, a scenario shall be realistic, shall be based on the relevant technical information defined in this document (see Section 7.5 “Selecting data / background data” section above), and shall be chosen to be the most probable representative of alternatives which shall be declared. Processes and procedures that are not in current use or have not been demonstrated to be practical shall not be included in a scenario.

Declared optional modules shall be calculated for specified scenarios, and the relevant technical information (e.g., derived parameters) shall be documented in the background report together with the literary source (e.g., recycling rates).

EXAMPLE: A recycling system is not practical if it includes a reference to a return system for which the logistics have not been established.

EXAMPLE: Energy recovery not based on existing technology and current practice is not plausible.

# 8. Life cycle inventory analysis

## 8.1 Collecting data and calculation procedures

Data collection and corresponding calculation procedures shall consistently follow ISO 14044:2006 throughout the study, and they shall be documented in the background report. When transforming the inputs and outputs of combustible material into inputs and outputs of energy, the net caloric value specific to the material shall be applied based on scientifically accepted values.

## 8.2 Allocations

Most industrial processes produce more than the intended product[10]. Normally, more than one input flow is needed to produce one product, and sometimes products are co-produced with other products. As a rule, the material flows between them are not distributed in a simple way. Intermediate and discarded products can be recycled to become inputs for other processes. When dealing with systems involving multiple products and recycling processes, allocation should be avoided as far as possible. Where unavoidable, allocation should be considered carefully and should be justified.

The use of upstream data which do not respect the allocation principles described in this document in line with ISO 14044:2006 allocation rules shall be clearly identified, subjected to a sensitivity analysis conducted and documented so as to illustrate the likely influence on the results with the upstream data used, and justified in the background report.

The principle of modularity shall be maintained (as described in ISO 14025:2006 Clause 5.4). Where processes influence the product's potential environmental performance during its life cycle, they shall be assigned to the module in the life cycle where they occur. In other words, all environmental aspects and potential impacts are declared in the life cycle stage where they appear.

For all allocation situations, the sum of the allocated inputs and outputs of a unit process shall be equal to the inputs and outputs of the unit process before allocation. This means that no double counting or omissions of inputs or outputs through allocation are permitted or justified.

Irrespective of the allocation approach chosen for a co-production process or for secondary flows crossing the system boundary between product systems, specific inherent properties of such co-products or flows, for example calorific content, composition (biogenic carbon content, $CaO/Ca(OH)_2$ content, etc.), shall not be allocated but always reflect the physical flows.

Allocation to co-products shall respect the main purpose of the processes studied, allocating all relevant products and functions appropriately. The purpose of a plant and therefore of the related processes is generally declared in its permit and shall be taken into account. Where the revenue from a process is a significant reason for its existence, the proportion of revenue associated with each co-product should be broadly reflected in whichever allocation approach is used for co-products. This is to avoid disproportionate allocation of impacts to co-products.

In situations where it is unclear if an output is a co-product, by-product, or a waste, a conservative approach of allocating burdens to the primary product system under consideration shall be used. The final

[10] In industrial processes, there may be a wide variety of different types of materials produced in conjunction with the intended product. In business vocabulary, these may be identified as by-products, co-products, intermediate products, non-core products or sub-products. In this document, these terms are treated as being equivalent. However, for the allocation of environmental aspects and impacts a distinction between co-products and products is made in this document.

disposal of wastes is included in the system boundary of the process that generated them.

Consistent allocation procedures shall be uniformly applied to similar inputs and outputs of the system under consideration. For example, the approaches of allocation to co-products or to secondary materials crossing the system boundary between product systems should use the same procedure used for co-products or to secondary material flows entering the product system.

Impacts from allocated co-products shall not be included in module D.

A conservative approach may be used for the assessment of the primary product by not allocating any environmental flows to a co-product and retaining all impacts within the primary product system. Where a co-product is a relevant input, then the allocation procedure shall be followed to understand the impacts that are allocated from the joint co-production process to the co-product.

## 8.3 Co-product allocation

Allocation shall be avoided as far as possible by dividing the unit processes to be allocated into different sub-processes that can be allocated to the co-products, and by collecting the input and output data related to those sub-processes. If a process can be sub-divided but the respective data is not available, the inputs and outputs of the system under study should be partitioned between its different products or functions in a way which reflects the underlying physical relationships between them. In other words, the physical relationships shall reflect the way in which the inputs and outputs are influenced by the quantitative changes of the products or functions (i.e., the outputs and/or services provided by the process, having a positive economic value) delivered by the system.

Co-product allocation shall be performed in the order of the following steps:

- Identify whether the unit process is a joint co-production process; if each of the co-products can be produced without the other(s) or the ratio of the co-products typically varies in normal production, then it is not a joint co-production process. By-products cannot be avoided and processes producing by-products are therefore joint co-production processes.
- If the unit process is not a joint co-production process, then the unit process should be subdivided into two or more unit processes (one of which represents the studied product) having separate input and output data for each individual unit process.
- If the unit process is not a joint co-production process and the unit process should be subdivided but if respective data are not available, the inventory of the unit process under study should be allocated between its different products or functions in a way that reflects the underlying physical relationships between them.
- In other cases, such as joint co-production processes, the inventory of the process should be allocated between the products and co-products in a way that reflects underlying physical relationships between them, i.e., they should reflect the way in which the inputs and outputs are changed by quantitative changes in the products or functions delivered by the system.
- In all other cases, including joint co-production processes, where no relevant underlying physical relationships between the products and co-products can be identified, the inventory of the process should be allocated between the products and co-products in a way that reflects the economic value of the co-products when they leave the unit process. The economic value of the co-products may be assessed by considering the proportion of revenue generated by each co-product. The revenue is the price multiplied by the output. For both price and output, representative values should be identified (e.g., rolling annual averages). Prices alone are not considered to be the appropriate basis for the decision. Allocation on a purely economic basis shall not be used so as to avoid impacts to any co-products that are either produced or used in the manufacture of products.

Avoiding allocation is not a type of allocation. However, for the purposes of this document, any approach to assigning impacts to co-products, whether by allocation or by avoiding allocation, shall be considered as allocation and shall follow the principles for allocation set out in this document.

If there is a need to calculate impact data for both products and co-products, system expansion (the approach of expanding the product system to include the additional functions related to the coproducts) is not considered as an option for avoiding allocation within EPD studies. It shall not be used to avoid the allocation of impacts to any co-products which are produced or used in the manufacture of products.

NOTE 1: A common position on the definition of the most appropriate allocation rule needs to be defined together with other relevant sectors as allocations rules are inherently sector-specific.

NOTE 2: Allocation of plant data affecting the declared products must be documented. See section 7.4: Criteria for the exclusion of inputs and outputs (cut-off rules).

## 8.4 Allocation of multi-input processes

Multi-input processes refer to situations where various products are processed together within an individual process (e.g., a waste incineration plant, a bio-power station, or a landfill site). The LCA study shall first identify any unit process that produces more than one product, then determine whether it is possible to divide the unit process into one or more subprocesses that each have a single output. Then separate input and output data related to these individual subprocesses can be collected.

Avoiding allocation by subdivision is suitable for unit processes with co-products whose manufacture is not intrinsically linked. This may occur, for instance, when data collection is performed at a given location without going deeper into detail regarding specific processes occurring at that site, for example separate production lines or sequential manufacture of products. For these types of processes, the ratio between the co-products could be significantly altered or only one co-product produced, when required. In such cases, subdivision shall not be used, and the co-product allocation procedure shall be used. If necessary, the potential environmental impacts linked with the inputs are distributed depending on how they influence the subsequent production processes.

Subdivision is more problematic for unit processes where the co-products manufactured are intrinsically linked and are true joint co-products. This is normally the case if the ratio between the coproducts cannot be significantly varied, for example, because they are produced from the same input material(s) and co-production is unavoidable.

## 8.5 Allocation procedure for reuse, recycling, and recovery

The end-of-life system boundary of the product system is set where outputs of the system under study (e.g., materials, products, or construction elements) have reached the system boundary between product systems. Therefore, waste processing of the material flows (e.g., undergoing recovery or recycling processes) within any module of the product system (e.g., during the production stage, use stage, or end-of-life stage) are included in the system boundary of the respective module as defined in this document. No burdens are allocated across the system boundary with secondary material, secondary fuel, or recovered energy flows arising from waste.

There is no allocation across the system boundary between product systems with respect to secondary materials, secondary fuels, or recovered energy arising from pre-consumer and post-consumer recycling. Recovery processes carry no allocated burdens and have no impact when they cross the system boundary between product systems and there is no allocation of impacts away from the studied product system to any wastes that are reused, recycled, or recovered for use in subsequent product systems.

Where a secondary material or fuel crosses beyond the system boundary of the studied product system, and it substitutes another material or fuel in the following product system, the potential benefits or avoided loads can be calculated based on a specified scenario which is consistent with any other scenario for waste processing and is based on current average technology or practice. If today's average is not available for the quantification of potential benefits or avoided loads, a conservative approach shall be used.

Where relevant, the optional Module D declares potential loads and benefits of secondary materials, secondary fuel, or recovered energy leaving the product system. Module D recognizes the "design for reuse, recycling, and recovery" concept by indicating the potential benefits of avoided future use of primary materials and fuels while taking into account the loads associated with the recycling and recovery processes beyond the system boundary.

Module D does not show allocated impact and is not a form of allocation as there is no allocation of burdens across the system boundary. Module D is provided as optional and supplementary information that can be used to demonstrate the potential loads and benefits associated with any net outflows of secondary material, secondary fuel or recovered energy crossing the system boundary between product systems. See section 6.6 above to calculate the impacts of net flows in module D.

When selecting the substituted processes for energetic utilization of the product, the appropriate national or regional processes should be selected where significant market shares are held.

In alignment with the 2022 Allocating Burdens and Benefits of Materials Shared Across Product Systems addendum to the ACLCA Open Standard v1.0, during Part B creation PCR committees consider allocation protocols used by related adjacent product categories in the value chain.

## 8.6 Mass balance chain of custody

The acceptability and best practices of mass balance approaches in LCA are still subjects of debate as of the last update of this PCR. Until specific standards or guidance are available, mass balance approaches shall not be used in EPDs. If and when mass balance standards or guidance for LCA become available, results using mass balance may only be presented as alternative scenario results in an EPD, and not as primary results. Alternative scenario results shall follow appropriate best practices in a cited standard/guidance document.

## 8.7 Life cycle inventory indicators

Life cycle inventory indicators represent elementary flows and are measured or calculated directly from the inventory data. Resource use indicators, output flows and waste category indicators, and carbon emissions and removals reflect the flows from and to nature for the product system, prior to characterization using an impact assessment methodology to calculate life cycle impact assessment results.

The LCI indicators listed in Table 3 shall be reported in the EPD using scientific notation with three significant digits. Abiotic depletion potential for fossil resources (ADPf) shall be calculated using the CML[11] impact assessment methodology. Other indicators may be calculated with the help of American Center for Life Cycle Assessment's (ACLCA) guidance for calculating these metrics (https://lcacenter.org/products/iso-21930-guidance). Removals shall be accounted for as a negative value (e.g., 1 kg of biogenic $CO_2$ removed from the atmosphere is reported as -1kg $CO_2$).

Accounting of biogenic carbon removals and emissions shall follow the requirements of section 7.2.7 of ISO 21930:2017, regardless of whether the EPD intends to conform to that standard. Biogenic carbon removals and emissions shall be reported in the module where they occur. If the removals or emissions occur in a module which is outside the scope of the LCA, they may be reported separately in a technical scenario table for clarity. For additional guidance in calculating the amount of biogenic $CO_2$ in the product or the packaging, see sections 8.1 and 8.2 in the May 2019 ACLCA Guidance to Calculating Non-LCIA Inventory Metrics in Accordance with ISO 21930:2017[12].

> EXAMPLE: In a cradle-to-gate LCA, biogenic removals related to wood-based packaging are accounted for in A3 with all other LCI indicators, and biogenic emissions from packaging are reported separately in a technical scenario table for A5.

[11]Heijungs R., Guinée J.B., Huppes G., Lankreijer R.M., Udo de Haes H.A., Wegener Sleeswijk A. Environmental Life Cycle Assessment of Products: Guide and Backgrounds. CML. Leiden University, Leiden, 1992.
[12] ACLCA Guidance to Calculating Non-LCIA Inventory Metrics in Accordance with ISO 21930:2017 https://lcacenter.org/products/iso-21930-guidance

Table 3. Life cycle inventory indicators

| Indicator | Acronym | Unit |
|---|---|---|
| ***Resource use indicators*** | | |
| Renewable primary resources used as an energy carrier (fuel) | **$RPR_E$** | MJ, LHV |
| Renewable primary resources with energy content used as a material | **$RPR_M$** | MJ, LHV |
| Total use of renewable primary resources with energy content | **$RPR_{total}$** | MJ, LHV |
| Non-renewable primary resources used as an energy carrier (fuel) | **$NRPR_E$** | MJ, LHV |
| Non-renewable primary resources with energy content used as a material | **$NRPR_M$** | MJ, LHV |
| Total use of non-renewable primary resources with energy content | **$NRPR_{total}$** | MJ, LHV |
| Secondary materials | **SM** | kg |
| Renewable secondary fuels | **RSF** | MJ, LHV |
| Non-renewable secondary fuels | **NRSF** | MJ, LHV |
| Recovered energy | **RE** | MJ, LHV |
| Consumption of freshwater | **FW** | $m^3$ |
| Abiotic depletion potential for fossil resources | **ADPf** | MJ, LHV |
| ***Output flows and waste category indicators*** | | |
| Hazardous waste disposed | **HWD** | kg |
| Non-hazardous waste disposed | **NHWD** | kg |
| High-level radioactive waste, conditioned, to final repository | **HLRW** | kg |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | **ILLRW** | kg |
| Components for re-use | **CRU** | kg |
| Materials for recycling | **MR** | kg |
| Materials for energy recovery | **MER** | kg |
| Recovered energy exported from the system | **EE** | MJ |
| ***Carbon emissions and removals*** | | |
| Biogenic carbon removals from product | **BCRP** | kg $CO_2$ |
| Biogenic carbon emissions from product | **BCEP** | kg $CO_2$ |
| Biogenic carbon removals from packaging | **BCRK** | kg $CO_2$ |
| Biogenic carbon emissions from packaging | **BCEK** | kg $CO_2$ |
| Carbon emissions from calcination | **CCE** | kg $CO_2$ |
| Carbon removals from carbonation | **CCR** | kg $CO_2$ |
| Carbon emissions from combustion of waste from renewable sources used in production processes | **CBCEW** | kg $CO_2$ |
| Carbon emissions from combustion of waste from non-renewable sources used in production processes | **CWNR** | kg $CO_2$ |

# 9. Life cycle impact assessment and estimated impacts

The framework follows the Option A methodology in the development of EPDs as outlined in ISO 14025:2006 Clause 6.8.2. The results of the LCA must be depicted in the background report in tabular form for all included modules similar to that of Table 2.

## 9.1 Life cycle impact assessment (LCIA)

The Life Cycle Impact Assessment (LCIA) results are calculated using the TRACI impact assessment methodology developed by the EPA, as it is a well-respected and widely-used impact assessment methodology in North America, and the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report. The impact indicators are derived by using the 100-year time horizon[13] factors, where relevant, as defined by TRACI 2.2 (Bare 2014, updated 2022) classification and characterization. It may also be necessary to report additional methodologies for compliance with other standards.

NOTE: It is required to include a statement in the background report that LCIA results are relative and do not necessarily predict impacts on each respective category's end points, thresholds' exceedance, safety, and health risks.

Results are **required** to be presented in the EPD for the impact categories shown in Table 4 using scientific notation with three significant digits.

**Table 4.** Required impact categories and units ● TRACI 2.2 impact assessment methodology (EPA) and IPCC AR6

| Impact category | Unit | Methodology |
|---|---|---|
| Total global warming potential ($GWP_{total}$) | kg $CO_2$ eq | IPCC AR6[14] |
| Global warming potential from fossil fuels ($GWP_{fossil}$) | kg $CO_2$ eq | IPCC AR6 |
| Global warming potential from biogenic ($GWP_{biogenic}$) | kg $CO_2$ eq | IPCC AR6 |
| Global warming potential from land use and land use change ($GWP_{luluc}$) | kg $CO_2$ eq | IPCC AR6 |
| Acidification | kg $SO_2$ eq | TRACI 2.2 |
| Eutrophication: freshwater | kg P eq | TRACI 2.2 |
| Eutrophication: marine | kg N eq | TRACI 2.2 |
| Ozone depletion | kg CFC-11 eq | TRACI 2.2 |
| Smog | kg $O_3$ eq | TRACI 2.2 |

Additional results may **optionally** be presented in the EPD for the impact categories shown in Table 5, using the TRACI 2.2 impact assessment methodology.

**Table 5.** Optional impact categories and units ● TRACI 2.2 impact assessment methodology (EPA)

| Impact category | Unit | Methodology |
|---|---|---|
| Respiratory effects | kg PM2.5 eq | TRACI 2.2 |

NOTE: USEtox indicators[15] are used to evaluate toxicity-related impact categories. As such, LCIA results for carcinogenics (CTUh), non-carcinogenics (CTUh), and ecotoxicity (CTUe) may optionally be reported in the EPD as additional environmental information using the TRACI 2.2 impact assessment methodology (EPA).

[13] The 100-year period relates to the period in which the potential environmental impacts are modeled. This is different from the time period of the functional unit. The two periods are related as follows: all potential environmental impacts that are created in the period of the functional unit are modeled through life cycle impact assessment using a 100-year time horizon to understand the impacts that take place.
[14] Intergovernmental Panel on Climate Change (IPCC) https://www.ipcc.ch/report/ar6/
[15] USEtox is available in TRACI and at http://www.usetox.org/

Additional impact categories using additional impact assessment methodologies may optionally be reported. This is sometimes desired when the EPD is targeted towards additional geographical regions or when other EPDs in the same product category disclose other methods and comparability is sought.

Global warming potential shall be reported by disclosing the contributions to GWP from fossil fuels, biogenic carbon, and land use and land use change, plus the total from these contributions. These indicators can be calculated by using the method in Table 6. For more information, see Annex 2 of the International EPD System PCR for construction products[16].

The amount of biogenic carbon is an inherent material property, which sometimes is excluded or incorrectly accounted for in secondary data sets available in LCA software. Therefore, the amount of biogenic $CO_2$ in the product or the packaging is often calculated manually as an LCI indicator and incorporated into to the result calculated by the LCA modeling software (see section 8.7 of this document).

**Table 6.** Methods for calculating global warming potential contributions

| Indicator | Method for calculating |
|---|---|
| Total global warming potential ($GWP_{total}$) | $GWP_{fossil}$ + $GWP_{biogenic}$ + $GWP_{luluc}$ |
| Global warming potential from fossil fuels ($GWP_{fossil}$) | IPCC AR6 result from LCA tool |
| Global warming potential from biogenic ($GWP_{biogenic}$) | IPCC AR6 result from LCA tool + manually calculated biogenic $CO_2$ emissions and removals (per section 8.7) |
| Global warming potential from land use and land use change ($GWP_{luluc}$) | IPCC AR6 result from LCA tool + other relevant activities not captured in secondary data sets |

Upon request by the reviewer, the following shall be made available:

- When applicable, a list of substances and flows provided by the manufacturer from the foreground system which are not characterized by any of the chosen LCIA methods in this framework
- A comprehensive list of the substances in the LCI with names and quantities exported from the model in the LCA program without any cut-off[17]

Where an average composition, representative composition, or worst-case environmental indicators are used, the products included in an average EPD shall not differ in their environmental impact indicators (i.e., LCIA results) by more than ±10%. Where larger impact differences are found for the companies/sites and/or products evaluated, these need to be reported separately.

**Reporting of the water footprint and carbon footprint is optional.**
Water may be reported by following either ISO 21930:2017 section 7.2.13, ISO 14046:2016, or the GHG Protocol Product Life Cycle Accounting and Reporting Standard. The carbon footprint may be reported using either the GHG Protocol Product Life Cycle Accounting and Reporting Standard or ISO 14067:2018. The methodology name and version number should be presented on the EPD together with the results, either as a reference or in the name of the impact category.

[16] The International EPD System. Product Category Rules (PCR) for Construction Products, Annex 2. Version 2.01. EPD International AB, 2019.

[17] The reason no cut-off is allowed is because this is a calculated table and does not contain the original manufacturer's data.

## 9.2 Normalization and weighting

The Sustainable Minds millipoints along with the normalized LCA results prior to weighting may be reported. Normalization (Ryberg, 2014) and weighting (Gloria, 2007) were used as detailed in the SM2026 Methodology[18,19] and applied using the following table:

**Table 7.** Sustainable Minds normalization and weighting factors

| Impact category | Normalization | Unit | Weighting (%) |
|---|---|---|---|
| Acidification | 90.8 | kg $SO_2$ eq /year /capita | 4.1 |
| Ecotoxicity | 11100 | CTUe /year /capita | 9.6 |
| Eutrophication: freshwater | 0.438 | kg P eq /year /capita | 4.1 |
| Eutrophication: marine | 19.1 | kg N eq /year /capita | 4.1 |
| Global warming potential | 24200 | kg $CO_2$ eq /year /capita | 39.8 |
| Ozone depletion | 0.161 | kg CFC-11 eq /year /capita | 2.7 |
| Carcinogenics | 5.07E-05 | CTUh /year /capita | 10.9 |
| Non-carcinogenics | 1.05E-03 | CTUh /year /capita | 6.8 |
| Respiratory effects | 24.2 | kg PM2.5 eq /year /capita | 12.3 |
| Smog | 1390 | kg $O_3$ eq /year /capita | 5.5 |

NOTE: Weighting cannot be used for comparative assertions intended to be disclosed to the public. Using the same weighting for all industries and regions may lead to disproportionate spikes that can dominate the assessment by several orders of magnitude for certain product types.

Long-term emissions (>100 years) are not taken into consideration in the impact estimate.

The following must also be indicated in the LCA background report:
- Reference to all characterization models, characterization factors, and methods used, as defined in this document
- A statement that the impact estimate results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins, or risks

## 9.3 Life cycle interpretation

Interpretation of the LCA results in the background report should at least discuss the parameters describing the potential environmental impact with reference to the declared unit and major specifications influencing the results. Interpretation shall also include the following:
1. Interpretation of the results based on a dominance analysis of selected indicators for the relevant modules. All processes or materials that have a contribution of 20% or more in any of the LCA results (= relevant impacts) must be identified (overall and in each life cycle stage). Materials or processes that are considered proprietary by the manufacturer may be described with a generic descriptor which includes role and/or function.
2. The relationship between the Life Cycle Inventory Analysis results and the results of the potential environmental impacts.
3. A sensitivity analysis using the highest and lowest values for the most important choices and assumptions should be performed to check the robustness of the results of the LCA (disregarding outliers is appropriate). If a sensitivity analysis is performed, identifying which choices or assumptions

[18] Joep Meijer et al., Sustainable Minds SM2026 Methodology and Database, February 2026.

[19] Learn about SM Single Score results https://transparencycatalog.com/learn-single-score

influence the results in any environmental parameter by more than 20% shall be reported. Additionally, the chosen approach for the following parameters should also be reported:

- The impact of the geographical and technological variation on various production locations
- The variation due to using average composition
- The variation due to using a group average
- Allocation of recycling processes
- Allocation of multi-input and multi-output processes.

4. Data quality assessment. For “Procurement” or “Data source” level conformance to the ACLCA PCR Open Standard v1.0, the enhanced pedigree matrix (EPM) as described in the addendum “Assessing Data Quality of Background Life Cycle Inventory Datasets (2022)” must be used.
5. Full transparency in terms of values-choices, rationales, and expert judgments.

# 10. Documentation of additional information

Any additional information shall be documented in the background report including the following:
- Factual statements supported by appropriate internal and verified external documentation that relevant programs and plans to improve the potential environmental performance of the product are implemented or being implemented. The essence is providing a description about what the company is doing about the relevant impacts and efforts made to minimize them.
- Self-declared content about programs, strategies, and successes, as long as they are relevant to the potential environmental performance of the product

Additional environmental information related to the product's overall potential environmental performance is used where relevant, whether LCA-based or not. This information is presented to ensure that all relevant environmental aspects of the product are covered in the EPDs.

## 10.1 Relevant additional data related to potential environmental performance

All declared data and/or certifications require reference(s) and must conform to the applicable standards for the region declared. In markets where the emission of dangerous substances is regulated, this information is a mandatory part of additional environmental information. Regulated substances of very high concern shall be declared, if relevant.

This must include:
- Statements that relate to the scope of the EPD

This can include:
- Certificate's logo, certificate numbers, and/or other relevant references
- Statements about potential environmental performance
- Organization's adherence to any environmental management system, with a statement on where an interested party can find details of the system, if relevant.
- For relevant markets, declare substances that are regulated. For example, under the European REACH program in case the product is available on the European market, declare the following: 'the product contains no substances from the REACH Candidate list' or 'the product contains substances that are less than 0.1% by weight on the REACH Candidate list' or 'the product contains substances from the REACH Candidate list'. When the last category is relevant, list the substances.

For cradle-to-gate EPDs, the following may be qualitatively reported as additional environmental information if known:
- Other products not included in assessment needed for product to serve intended function
- Anticipated replacement cycle of product
- Intended use
- Potential waste treatment scenarios

## 10.2 Laboratory results and scenario-related information

The background report shall include any documentation on additional environmental information declared in the EPD. The purpose of this documentation is to provide the verifier with details regarding any statements made in the EPD. Such documentation (e.g., copies or references) may include:
- laboratory results/measurements related to the content's declaration

- laboratory results/measurements related to the functional/technical performance
- documentation on declared technical information on life cycle stages that have not been considered in the LCA of the product but will be used for other related assessments (e.g., transport distances, energy consumption during use, cleaning cycles, etc.)
- laboratory results/measurements related to declarations of emissions to indoor air, soil, and water during the product's use stage

## 10.3 LCA background report requirements for renewable electricity instruments

When renewable energy is incorporated in the LCA results, calculations and reporting are in alignment with the 2023 Quantifying Renewable Electricity Instruments in Environmental Product Declarations (EPDs) addendum to the ACLCA PCR Open Standard. Upon publication of an updated version of this addendum, Sustainable Minds will review the update and consider incorporation into Part A.

The following details of the nature of renewable energy contributions shall be included in the LCA background report and in the interpretation section of the EPD:

- Renewable fuel type (wind, solar, etc.)
- Percent of manufacturer's product-related electricity covered (if <100%, grid type used to model remaining electricity (consumption grid, residual grid, supplier mix, etc.))
- Commitment pledged for entire validity of EPDs published under the LCA (yes/no)

The following additional details, where relevant, shall be included in the LCA background report:

- Renewable generator project name
- Tracking system ID (unique generator ID)
- Renewable facility/generator owner
- Renewable facility/generator location (state/province)
- Project vintage (build date) (year)
- Project generation date (year first produced renewable energy)
- Nameplate capacity of project (MW)
- Certificate type
- Certificate unique ID
- Month and year of renewable energy generation
- Month and year certificate issued
- Utility to which the project is interconnected

Links to Green-e® or additional information about the RECs should be included in the LCA background report.

## 10.4 $CO_2$ certificates

$CO_2$ certificates such as Carbon Offsets cannot be utilized in the LCA study in that they cannot be used to reduce the total quantity of carbon dioxide equivalents reported in the study. However, they can be qualitatively described as part of the manufacturer's potential environmental performance improvement methods and techniques in the EPD, as outlined in Appendix C section 6. The manufacturer must provide documentation showing ownership of the environmental benefit of such certificates for the entire duration of the validity of the EPD.

# 11. Benchmarking guidance

## 11.1 Manufacturer-average or facility-specific EPD benchmarking guidance

When a manufacturer-average or facility-specific EPD is benchmarked against an existing older version of the EPD from the same manufacturer, any claim of environmental improvement shall be the result of measures, actions, or decisions implemented or taken by the company to reduce its environmental impact at the manufacturing plant, in its supply chain, or elsewhere in the life cycle of its products. The impact of measures, actions, or decisions shall be quantifiable, and their link to the environmental improvement claim shall be explicitly stated and explained in the EPD. In addition, the following requirements shall be met:

- Comparisons of building and construction product EPDs shall follow the requirements set forth in ISO 21930:2017 section 5.5. Comparisons of EPDs for non-building and construction products may only be made between EPDs with a cradle-to-grave system boundary. Generally, a change in the results greater than 10% is considered significant.
- Data sources as specified in Part B shall be consistent as it pertains to:
    - Priority of primary and secondary data sources
    - Application of background Life Cycle Inventory data sets and version; if LCI data set method updates occur between the publication of the benchmark EPD and updated EPD, the benchmark EPD results shall be recalculated using the most recent LCI data sets and used for benchmarking with the updated EPD
    - Application of specific secondary, non-Life Cycle Inventory (LCI) data
- Cut-off criteria for inclusion of mass and energy flows shall be consistently applied.
- Use phase calculations in the background report shall be consistently applied as outlined in Part B.
- End-of-life assumptions in module C shall be consistently applied as specified in Part B.
- Software and version of LCA modeling software used shall be consistent. If LCA software updates occur between the publication of the benchmark EPD and updated EPD, the benchmark EPD results may optionally be recalculated using the most recent software version and used for benchmarking with the updated EPD.
- The LCIA method and version shall be consistent between the benchmark and updated EPDs. If LCIA method updates occur between the publication of the benchmark EPD and updated EPD, the benchmark EPD results should be recalculated using the most recent LCIA method and used for benchmarking with the updated EPD.
- Sources of deviation from the benchmark EPD shall be documented and quantified, including but not limited to:
    - Number of manufacturing locations considered
    - Sourcing changes
    - Product design changes implemented
    - Process changes implemented
    - Processing waste treatment changes
    - End of life pathway changes

## 11.2 Guidance for creating and comparing to industry-average EPD

This guidance is for the purpose of establishing an industry-average EPD for use as a credible product group benchmark.

### Credibility

In order for a product group benchmark to be credible, it must be created with the participation of the industry, based on primary data from multiple manufacturers. It must be based on the relevant PCR and be verified. Any benchmark using only secondary data or data generated by someone other than the participating manufacturers will not be valid.

### Scope

The scope of the EPD being compared to a benchmark shall match the scope of the benchmark. Comparisons of building and construction product EPDs shall follow the requirements set forth in ISO 21930:2017 section 5.5. Comparisons of EPDs for non-building and construction products may only be made between EPDs with a cradle-to-grave system boundary.

### Availability

The program operator responsible for registration of the industry-average EPD is required to make it publicly available for use as a benchmark.

### Industry-average EPD creation requirements

- **The industry-average EPD shall be created for one product group, as defined in the Part B.** When an existing PCR represents more than one product group, each product group for which an industry-average EPD will be created must have its own industry-average EPD. No more than one industry-average EPD shall exist for each product group in each market.
- **A minimum threshold of market participation shall be met, as defined in the Part B.** The Part B industry-average EPD additional rules section specifies the market segmentation and coverage, the minimum required level of market participation, and how market share is measured. At least three participants representing the industry are required to create an industry-average EPD. Typically, the benchmark is created by taking a weighted average based on market share by each participant within the group participating in the creation of the industry-average EPD. When used, market share data shall be for the same year as the industry-average EPD data. Collection of market share data shall not violate anti-trust laws or restraint of trade laws.

### Industry-average EPD content requirements

In addition to the EPD content requirements set by the PCR, the following shall be included:

- LCIA method and version number
- Recommendations for improvement where feasible, based on a contribution analysis by impact category for the impact categories required by the industry-average EPD
    - Recommendations may be quantitative or qualitative
    - At least two recommendations should be included
        - Recommendations are meant to be industry-specific
        - Reduction targets are meant to be impact category-specific
    - Recommendations shall not be based on LCIA methodology changes (e.g., updates to electricity factors which has the appearance of reduced emissions)
    - Recommendations may set long-term improvement goals and establish an incremental path for achievement (e.g., Reduce global warming impacts by 30% by 2030; may refer to the 2030 Challenge for Products[20])
- State the number of participants and total market share of the group. Listing the name of the participants is only required for those participants who will at any time make comparisons to the industry-average EPD.
- Quantitatively describe the uncertainty of the industry-average results. The working group will determine the method used to determine quantitative uncertainty (e.g., Monte Carlo method).

[20] http://architecture2030.org/2030_challenges/products/

- The following statement or a similar statement regarding comparison limitations shall be included: “An LCA or LCIA shall not provide the sole basis of comparative assertion intended to describe overall environmental superiority or equivalence, as additional information will be necessary to overcome some of the inherent limitations in the study. Value-choices, exclusion of spatial and temporal, threshold and dose-response information, relative approach, and the variation in precision among impact categories are examples of such limitations. LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins, or risks.”

## 11.3 How to make a comparison to the industry-average EPD

This guidance is for comparing manufacturing-average or facility-specific EPDs to an industry-average EPD.

### Scope

Comparisons shall only be made for Type III environmental declarations with a cradle-to-grave scope.

### Requirements for comparison

- The modules declared in the manufacturing-average or facility-specific EPD shall be the same as those declared in the industry-average EPD
- The manufacturing sites used in the manufacturing-average or facility-specific EPD shall be the same those used in the industry-average EPD or submitted for use in the next update of the industry-average EPD
- To demonstrate impact reduction below industry average, the manufacturing-average or facility-specific EPD results shall be lower than the industry-average EPD results by the threshold for improvement set by the Part B industry-average EPD additional rules section
- Provide justification when impacts in any required impact category are greater than 100% above the industry average
- LCIA method and version number shall be the same
- Any comparisons made shall include the industry-average EPD results, the manufacturing-average or facility-specific EPD results, the percent improvement or reduction for each impact category being compared, and interpretation identifying what contributed to the improvement or reduction.
- Specify if the manufacturer is a participant in the original industry-average EPD or if data has been submitted for inclusion in the next update to the industry-average EPD.
- Comparisons optionally made within the manufacturing-average or facility-specific EPD shall be reviewed by the EPD verifier.

# Appendix A: Impact assessment methodology

The impact assessment is based on the TRACI methodology (Bare, 2014) and the Intergovernmental Panel on Climate Change (IPCC) reports. TRACI (the Tool for the Reduction and Assessment of Chemical and other environmental Impacts) was developed for sustainability metrics, life cycle impact assessment, industrial ecology, and process design impact assessment for developing increasingly sustainable products, processes, facilities, companies, and communities.

TRACI 2.1 allowed an expanded quantification of stressors that have potential effects, including ozone depletion, global warming, acidification, eutrophication, photochemical smog formation, human health particulate effects, human health cancer, human health noncancer, ecotoxicity, and fossil fuel depletion effects.

TRACI 2.2 includes updated eutrophication potential characterization factors for marine and freshwater environments and removes the fossil fuel depletion characterization factors.

The original version of TRACI was released in August 2002 (Bare et al. 2003) followed by a release of TRACI 2.0 in 2011, TRACI 2.1 in 2012, and TRACI 2.2 in 2022.

The IPCC was set up to provide regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation. AR6 is the Sixth Assessment Report which reflects recent climate science advances resulting from progress in, and the integration of, multiple lines of evidence, including: in situ and remote observations; paleoclimate information; understanding of climate drivers and physical, chemical, and biological processes and feedbacks; and global and regional climate modelling; as well as advances in methods of analyses and insights from the growing field of climate services.

# Appendix B: Overview of changes to this document

| | |
|---|---|
| Date: February 2026 | |
| Sustainable Minds Transparency Report [EPD]™ Framework | Version: v4.0 |

| # | **Clause No./ Subclause No./ Annex** (e.g., 3.1) | **Paragraph/ figure/table/note** (e.g., Table 1) | **Comment** Justification for change/ question | **Proposed change** | **Decisions** on each comment submitted | **Decision date** |
|---|---|---|---|---|---|---|
| 1. | Parts A and B | | Adapting to LCA best practices | Conformance to ISO 21930:2017 | | Aug 2023 |
| 2. | Compatibility appendices | | Integrating necessary requirements into the Framework, and providing space on Page 4 for addition of other content required by other PCRs | Retirement of compatibility appendices | | Aug 2023 |
| 3. | Parts A and B, and governance document | | Responding to needs of the industry | Allowance for conformance to v1 of the 2022 ACLCA PCR guidance | | Aug 2023 |
| **#** | **Program document** | **Summary of changes** | | | | **Date of change** |
| 4.0 | Part A | • Alignment with various ACLCA PCR Open Standard addenda covering RECs, data quality, EPD types, burdens and benefits, and mass balance chain of custody<br>• EPD publishing option for building and construction products and services without a dedicated product-specific PCR<br>• Update to impact assessment methods and to normalization and weighting factors<br>• Addition of LCI indicator reporting<br>• Other technical and editorial clarifications | | | | Feb 2026 |
| 5. | | | | | | |
| 6. | | | | | | |
| 7. | | | | | | |
| 8. | | | | | | |
| 9. | | | | | | |
| 10. | | | | | | |

# Appendix C: EPD content requirements

| Content list | What must be communicated to be an ISO 14025:2006 Type III environmental declaration |
|---|---|
| **1. Company & product Identification** | |
| **Brand identification – company logo, product logo** | |
| **Company contact info** | Name, corporate address, URL |
| **Product photo(s)** | As it looks when delivered |
| **Product name(s)/ID(s)** | That the market recognizes |
| **Product(s) description** | Description of what it does for the end-user, standards followed (e.g., EN 13310:2003, Kitchen sinks – Functional requirements and test methods), dimensions of the product(s), the use and/or area of application, material type, sub-category, the represented site(s)/plant(s), and other pertinent physical properties and technical information |
| **Product identification (e.g., model number)** | |
| **Part B / PCR identification** | Reference the PCR(s) used to create the EPD. Include who the PCR review was conducted by. |
| **Performance Dashboard** | **Functional performance** |
| | User inserts product category-specific attribute list with scores. Required to be on the market or industry-accepted attributes. |
| | **Potential environmental performance** |
| | - Declared product unit |
| | - Single figure scores by Sustainable Minds impact scores and life cycle stage (optional) |
| **Attributes** | **Functional performance** |
| | Additional attributes that describe product performance, but not required to satisfy a minimum legal standard. |
| | **Potential environmental performance** |
| | Attributes that are relevant to the LCA results and are expected to reduce the potential environmental impacts. |
| **Certifications** | **Functional performance** |
| | Mandatory and optional |
| | **Potential environmental performance** |
| | Mandatory and optional |
| **2. Issuing party and verification information** | |
| **Issuing party information** | Name, program name, address, logo, website |
| **Third-party verifier information (when relevant)** | Name, website, email address |
| **Release date, valid until (5 years after release date, or as specified by the PCR)** | |
| **Reference to full LCA report** | Include title, release date, and software type and version used |
| **Non-comparability statement** | Include the following statement or similar non-comparability statement:<br>"**Transparency Reports [EPDs]™ enable purchasers and users to compare the potential environmental performance of products on a life cycle basis.** They are designed to present information transparently to make the limitations of comparability more understandable. EPDs of products that conform to the same PCR and include the same life cycle stages, but are made by different manufacturers, may not sufficiently align to support direct comparisons. They therefore cannot be used as comparative assertions unless the conditions as defined in ISO 14025:2006 Section 6.7.2. 'Requirements for Comparability' are satisfied." |
| **Verification level** | Choose one of the following: |
| | □ Verified report and LCA results |
| | □ Self-declared report with ISO 14044 3rd party reviewed LCA results |
| | □ Self-declared report with self-declared LCA results |
| **Verification statement** | Include statement of verification (e.g., The LCA and background report are independently verified to the Sustainable Minds Transparency Report [EPD]™ Framework and ISO 14025:2006). Statement |

| | |
|---|---|
| | shall include PCR(s) used and, where relevant, the type of EPD developed according to the ACLCA Open Standard v1.0 (refer to Part B for level of conformance). |
| **Scope** | Choose one of the following |
| | □ Cradle-to-grave (max) |
| | □ Cradle-to-gate with options |
| | □ Cradle-to-gate (min) |
| **Time coverage** | Indicate the 12-month period for which primary data have been collected. |

## 3. LCA results

| | |
|---|---|
| **Functional unit** quantified performance of a product system for use as a reference unit (for cradle-to-grave) | In the functional unit description, include: Quantity, performance, application, reference service life (RSL) |
| **Declared unit** (for cradle-gate or cradle-to-gate with options) | In the declared unit description, include: Quantity, performance, application |
| **Material composition** | What's in the product – list contents larger than 1% by weight, describe remainder in aggregate. Include the product and other materials that are within the scope of this report. Create a table declaring the product composition information. Materials that exist in the product that are considered proprietary by the manufacturer may be described with a generic descriptor which includes role and/or function. Additionally, where necessary, materials may be reported with a corresponding reasonable range of mass percentages for which they exist in the product or product range.<br>Table headers: Component \| Material \| % by weight<br><br>Additionally, specify materials and substances that can adversely affect human health and/or the environment, in all stages of the life cycle, including a description of the regulated substance, the CAS number, and a reference to standard(s) or regulation(s) applicable for the relevant market. If no such materials are present, a statement shall be added to attest. |
| **Numeric LCA results** (defined by TRACI, needed for LEED, millipoints), broken down in cradle-to-gate, use phase and end-of-life; info-graphics | Inclusion of [A1], [A2], [A3] are a mandatory minimum and for 'cradle-to-gate'. 'Cradle-to-grave' studies must include all life cycle stages [A1-C4], where module D is optional. All other studies are referred to as 'cradle-to-gate with options'.<br><br>List the inclusions & exclusions for the following and add explicit details about exclusions. Indicate the impact assessment version used. |

| **Life cycle stages** | **Production** | **Construction/ Installation** | **Use** | **End of life** | **Recovery** |
|---|---|---|---|---|---|
| **Bold the information levels modules included:**<br>**Include photos to illustrate life cycle stages. Actual manufacturer's photos preferred vs. stock.** | | | | | |
| Information modules | A1 Supply chain | A4 Delivery | B1 Use | C1 Demolition | D Reuse, recovery and/or recycling |
| **Included**/Excluded | A2 Transportation | A5 Installation | B2 Maintenance | C2 Transportation | |
| | A3 Manufacturing | | B3 Repair | C3 Waste processing | |
| | | | B4 Replacements | C4 Disposal | |
| | | | B5 Refurbishments | | |
| | | | B6 Energy | | |
| | | | B7 Water | | |

| **SM2013 mPts (optional)** | **Production** | **Construction/ Installation** | **Use** | **End of life** | **Recovery** |
|---|---|---|---|---|---|
| **Indicate total impacts by life cycle stages [mPts per declared/functional unit]**<br>**Caption explaining materials or processes contributing significantly (e.g., >20%) to total impacts in each life cycle stage** | | | | | |

| Impact category | Unit | Production | Construction/ Installation | Use | End of life | Recovery |
|---|---|---|---|---|---|---|
| **Ecological indicators** | | | | | | |
| **Global warming** | **kg $CO_2$ eq (carbon dioxide)** | | | | | |
| **Acidification** | **kg $SO_2$ eq** | | | | | |
| **Marine eutrophication** | **kg N eq (nitrogen)** | | | | | |
| **Freshwater eutrophication** | **kg P eq (phosphorus)** | | | | | |
| **Ozone depletion** | **kg CFC-11 eq** | | | | | |
| **Human health indicators** | | | | | | |
| *Respiratory effects (optional)* | *kg PM2.5 eq* | | | | | |
| **Smog** | **kg $O_3$ eq (ozone)** | | | | | |
| **Additional environmental information** | | | | | | |
| *Ecotoxicity (optional)* | *CTUe* | | | | | |
| *Carcinogenics (optional)* | *CTUh* | | | | | |
| *Non-carcinogenics (optional)* | *CTUh* | | | | | |

## 4. Variations that drive performance

| | |
|---|---|
| **Important parameters within the LCA, what are the major contributions**<br><br>**What things have range or variations, and the relevance** | Report:<br>• All processes or materials that have a major contribution (e.g., of 20% or more) in any of the LCA results (= relevant impacts)<br>• A sensitivity analysis for the most important choices and assumptions must be performed to check the robustness of the results of the LCA. Indicate the quantitative results of this analysis.<br><br>Topics include:<br>• The impact of the geographical & technological variation over the different production locations.<br>• The variation due to variation in the average composition.<br>• The variation due to averaging for drawing up a 'group-average'.<br>• For the above, use the highest and lowest values in the sensitivity analysis. Outliers can be disregarded.<br>• Allocation of recycling processes.<br>• Allocation of multi- input and multi-output processes. |
| **Results Interpretation** | What's causing the greatest impacts, in which life cycle stages, and what is the company doing about them? |

## 5. Relevant additional environmental data related to potential environmental performance

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| | All declared data and/or certifications require reference and must conform to the applicable standards for the region declared in the functional unit. This can include:<br>• Certificate logos, certificate numbers, and/or other references. Use logos when possible, linked to the organization's web site.<br>• For cradle-to-gate EPDs, the following may be qualitatively reported if known:<br>  o Other products not included in assessment needed for product to serve intended function<br>  o Anticipated replacement cycle of product<br>  o Intended use<br>  o Potential waste treatment scenarios<br>• Statements that relate to the scope of the EPD<br>• |

| 6. Relevant product manufacturing/strategy about environmental ambition/programs | |
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| | • Relevant to LCA results<br>• Content about programs, strategies, and successes relevant to the potential environmental performance of the product. Detailed stories and images about potential environmental performance improvement methods and techniques such as: closed-loop recycling, up-cycling, sustainable supply chain efforts, etc. |
| **7. Finer details regarding LCA creation (additional EPD content)** | |
| **LCA results** | • Report results per each individual module, except for A1-A3 which may be aggregated<br>• Include the following waste categories for all information modules included in the EPD:<br>o Hazardous waste disposed, in kg<br>o Non-hazardous waste disposed, in kg<br>o Radioactive waste disposed<br>o High-level radioactive waste, conditioned, to final respiratory, in kg or m3<br>o Intermediate- and low-level radioactive waste, conditioned, to final respiratory, in kg or m3<br>• Include the following output flow categories for all information modules included in the EPD:<br>o Components for reuse<br>o Materials for recycling<br>o Materials for energy recovery<br>o Recovered energy exported from the product system<br>• Include the following material and resource use parameters<br>o Use of primary resources (several indicators)<br>o Use of secondary resources (several indicators)<br>o Abiotic depletion potential for fossil resources (ADPfossil)<br>o Consumption of freshwater resources<br>o Waste and output flows (several indicators)<br>• Include the following emissions<br>o Removals and emissions associated with carbon content of the bio-based product<br>o Emissions from calcination and removals from carbonation<br>o Removals and emissions associated with biogenic carbon content of the bio-based packaging<br>o Emissions from combustion of waste from renewable sources used in production processes<br>o Emissions from combustion of waste from non-renewable sources used in production processes<br>• For product-level EPDs that incorporate renewable energy, the following details of the nature of renewable energy contributions shall be included:<br>o Renewable fuel type (wind, solar, etc.)<br>o Percent of manufacturer's product-related electricity covered (if <100%, state grid type used to model remaining electricity (consumption grid, residual grid, supplier mix, etc.))<br>o Commitment pledged for entire validity of the EPD (yes/no)<br>o A note highlighting the need to update results if GWP results change by more than 10% if the percentage or type of renewable electricity changes<br>Separate results shall be reported in the EPD for the product with different REC allocations (e.g. Product Z and Product $Z_{RE}$) to ensure that product-specific volumes sold accurately match the allocated electricity consumed. It shall be clearly communicated to customers which results apply to the product they purchase. |
| **Data description** | • Describe the allocation procedure<br>• Describe the cut-off criteria |
| **Technical information** | • Include the following scenarios and additional technical information when the associated information module is included in the EPD and the information is relevant:<br>o All transportation after the gate<br>i. Type of transport<br>ii. Type of vehicle<br>iii. Distance |

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| | iv. Type and amount of energy carrier<br>o Installation (A5)<br>i. Description of the installation process or reference to where a description can be found<br>ii. Ancillary materials for installation specified by type and amount<br>iii. Product loss per functional unit or declared unit<br>iv. Quantitative description of energy use during installation, energy carrier type, for example electricity, and amount, if applicable and relevant<br>v. Quantitative description of water type and use during installation, for example source, amount used and fate (amount evaporated, amount disposed to sewer, etc.)<br>vi. Direct emissions to ambient air, soil, and water<br>vii. Output from the installation process including any waste treatment included in the scenario within the system boundary specified by recovery process.<br>o Use (B1-B5)<br>i. Direct emissions to ambient air, soil, and water<br>ii. Description of the maintenance, repair, replacement or refurbishment process or reference to where a description can be found<br>iii. Number of maintenance, repair, replacement, or refurbishment cycles per reference service life or required service life<br>iv. Ancillary materials specified by type (e.g., cleaning agent, specify materials) and amount<br>v. Quantitative description of energy type and use during maintenance, repair, replacement or refurbishment, energy carrier type, for example electricity, and amount, if applicable and relevant<br>vi. Quantitative description of water type and use during maintenance, repair, replacement, or refurbishment, for example source, amount used and fate (amount evaporated, amount disposed to sewer, etc.)<br>vii. Output from the maintenance, repair, replacement, or refurbishment process including any waste treatment included in the scenario within the system boundary specified by recovery process.<br>o Use (B6-B7)<br>i. Type and amount of energy carrier used (e.g., electricity, natural gas, district heating)<br>ii. Power output of equipment<br>iii. Characteristic performance (e.g., energy efficiency, emissions, variation of performance with capacity utilization)<br>iv. Further assumptions for scenario development (e.g., frequency and time period of use, number of occupants)<br>v. Quantitative description of water type and use, for example source, amount used and fate (amount evaporated, amount disposed to sewer, etc.)<br>o End of life (C1-C4)<br>i. Assumptions for scenario development, for example description of method of deconstruction, recycling, energy recovery and final disposal<br>ii. Collection, recycling and/or recovery rates and conversion efficiencies, as applicable<br>o Module D<br>i. Assumptions for scenario development, for example further processing technologies and selected substitution processes<br>ii. Process and conversion efficiencies, as applicable, and assumptions on correction factors, as applicable<br>o Biogenic carbon removals and emissions shall be reported in the module where they occur. If biogenic carbon removals or emissions occur in a module which is outside the scope of the LCA, they may be reported separately in a technical scenario table for clarity. |