PEP ecopassport® PROGRAM

PCR

Product Category Rules for Electrical, Electronic and HVAC-R Products

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1. Introduction

1.1. Scope

The specifications provided in this document are part of the Type III environmental declaration program, entitled PEP Ecopassport®, that provides an international reference framework for environmental declaration.

They constitute the Product Category Rules (PCR) of the program and define the rules for the development of Product Environmental Profiles (PEP) in compliance with ISO 14025 standard[1].

This PCR applies to Electrical, Electronic and Heating Ventilation Air Conditioning-Refrigeration (HVAC-R) products covered by the program, and include (but not limited to):

- Wires, cables, and accessories for energy, signalling, telecommunications, data and precision,
- Solutions for electrical installations and home automation,
- Opening and closure management systems, heating, air conditioning and lighting equipment,
- Electronic material for persons and building security,
- Self-contained emergency lighting systems,
- Routing and cable protection equipment,
- Process and industrial automation,
- Indoor, outdoor and public lighting,
- Equipment for renewable energy production,
- Electric heating equipment and electric water heaters,
- Heating and air conditioning equipment,
- Equipment for domestic hot water production,
- Ventilation and air handling equipment,
- Electric vehicle charging infrastructures,
- Photovoltaic equipment.

[1] ISO 14025:2006. Environmental labels and declarations - Type III environmental declarations - Principles and procedures.

It describes the required rules to ensure that PEPs created in the context of this Type III environmental declaration program are correctly drawn up and published with verifiable, comparable and non-misleading information.

Drawing up a PEP requires a product Life Cycle Assessment (LCA) which has been carried out in accordance with the rules described in EN 50693[2], ISO 14040[3] and ISO 14044[4] standards.

This reference document is mainly intended for:

- Product & Environment managers,
- Company LCA experts responsible for drawing up PEPs,
- Auditors entitled to assessing PEP and LCA report conformity according to the rules defined in this reference document.

Three types of PEP are covered by this PCR:

- Unitary product declaration – a declaration performed for a single commercial reference.
- Products family declaration – a declaration performed for several commercial references belonging to the same product family for a single manufacturer. Definition of an homogeneous product family is provided in 2.6Rule(s) for extrapolation to a homogeneous environmental family
- Joint declaration – a declaration performed for several products across multiple manufacturers. Conditions to perform a joint declaration is provided in 2.7 and detailed in Appendix A.

This document is the fourth version of the PCR that has been developed by the PEP ecopassport® program since 2009. To the best of our knowledge, at the time this PCR was published, no other Type III environmental declaration program exclusively covering electrical, electronic and HVAC-R products exists.

1.2. Contents of the document

This document includes the following parts:

- Common Rules for conducting Life Cycle Assessments

This part describes the common LCA rules to comply with for all the categories of products covered by the PEP Ecopassport® program. It also specifies the requirements regarding data selection and quality.

[2] EN 50693: 2019. Product category rules for life cycle assessments of electronic and electrical products and systems.

[3] ISO 14040: 2006. Environmental management – Life cycle assessment – Principles and framework.

[4] ISO 14044: 2006. Environmental management – Life cycle assessment – Requirements and guidelines.

- Description of the contents of LCA report

This part specifies the information that shall be included in the LCA report, which brings together all the necessary data to successfully complete the LCA and draft the PEP.

- Editorial rules for drafting a Product Environmental Profile

This part describes the editorial guidelines to draw up PEPs, i.e. the sections to be completed and the information to be provided.

- Appendices:
    A. Definition of the framework of validity for a joint declaration,
    B. Diagram of the system boundaries for the LCA,
    C. Specificities for drawing up the Product Environmental Profile within the French regulatory framework,
    D. Example of calculation of Module D,
    E. Data Quality Requirement (DQR),
    F. Alignment with ISO/TS 14067:2017,
    G. Terms and definitions,
    H. Bibliography,
    I. Recommended impact categories and indicators according to EN 50693,
    J. Critical review certificate.

The PCR is supplemented, if necessary, by additional Product-Specific Rules (PSR) defined for each product category that at least specifically present the functional units and additional information in relation to the common rules (e.g. use scenario). PSR are publicly available on PEP Ecopassport program website[5], their development, review and publication align with ISO/TS 14027:2017 Principles. The Procedure for the development and adoption of PSRs are available on the AP 0017 document, publicly available in PEP Ecopassport website.

Consequently, for a given product category, all the common rules and additional specific rules constitute a PCR for this category, as defined in ISO 14025 standard (see Figure 1).

[5] http://www.pep-ecopassport.org/find-a-pep/

Figure 1: Composition of PCR (common rules + PSRs) in the PEP ecopassport® program

For products not covered by PSRs issued by the PEP ecopassport® program, the PCR rules will apply.

However, it is recommended that the PEP ecopassport® program authorities be contacted to determine if there is a need to develop a PSR for the product category targeted and to identify the processes to be followed. Paragraph 6.4 PCR Preparation in ISO/TS 14027[6] shall be considered during the development of new PSRs, in particular the decision-making process in paragraph 6.4.3 Adaptation of existing PCR.

The PCR as well as the different PSRs are available from the PEP ecopassport® program. Additional information on PSR procedure are available on the AP0017 document of the PEP ecopassport® program.

2. Product Life Cycle Assessment

2.1. Functional unit and reference flow description

There are 2 options to report the environmental impact indicators of a product or a system declared in a PEP, each of them addressing different needs:

[6] ISO/TS 14027:2017. Environmental labels and declarations - Development of product category rules.

- The functional unit, to be used systematically when comparison between systems (products, solutions…) is required,
- The declared unit enhances the scalability of products environmental impact indicators at product or system level.

While the functional unit remains the same whatever the product fulfilling the same function is, the declared unit could vary depending on the technical specificities of a given product. The functional unit quantifies the performance of the service delivered by a product to the user. The main purpose of the functional unit is to provide a reference to which inputs and outputs are related in the LCA. The functional unit shall include:

- The identification of the product function(s) under study. The function(s) shall describe the service delivered to the user,
- The performance or requirement level achieved by the function(s). This level shall be quantified. It may be determined according to the standards applicable to the product,
- The reference service life (RSL).

The definition of the reference flow to fulfil the functional unit shall include:

- The quantitative amount of product(s), e.g. specified through their mass in kg, used to fulfil the functional unit: they will be named “reference product”,
- The materials not found in the reference product, including waste and discarded materials, which are generated at each stage of the life cycle (manufacturing process, cutting, installation, etc.),
- All the packaging used during the reference service life,
- Elements, flows and processes required to distribute, install, use (maintenance, repairs, replacements, etc.) remove, dismantle and process the reference product.

The declarant party shall systematically use the functional unit when a PEP is declared. The declared unit can be used in addition as a complementary information to help the future users of the PEP.

The declared unit is used as a reference unit in an environmental declaration when a functional unit cannot be used directly. When it is used, it must clearly specify:

- The quantity of product,
- The unit used (item, weight (kg), length (m), surface area (m^2), volume (m^3), etc.),
- The mathematical relation between functional unit and declared unit, if applicable the reference service life.

The standard content for expressing a declared unit is as follows:

- Ensure xx [function(s)] using a [main performance] [product or equipment] over a reference service life of x years (the [main performance] should be adjusted to reflect the relevant product in the range).

NOTE: For example, a combi heat pump:

- *The functional unit may be: "To produce 1 kW of heating and produce domestic hot water, according to the reference usage scenario and during a reference service life of 17 years."*
- *The declared unit may be: "Ensure the production of domestic hot water and heating using a 5 kW heat pump over a reference service life of 17 years (the power should be adjusted to reflect the relevant product in the range)."*

Where appropriate, the definitions of the functional unit, declared unit, reference service life and reference flow are given in the PSR.

The declaring party shall define and specify the functional unit in the PEP and the reference flow in the LCA report, as defined in paragraphs 3.3 and 4.1.4 of this document. The same rules are applicable if the declared unit is used, it shall be documented in the PEP and in the LCA report.

2.2. System boundaries

2.2.1. Presentation of the modularity principle

All aspects related to production, transportation, installation, use and end-of-life, up to the final disposal of a flow required to supply the considered stage, shall be allocated to the corresponding stage.

Therefore, each stage of the life cycle includes all the aspects related to its inputs and outputs. Regarding waste quantification, each stage includes the production, transportation, treatment and disposal of the waste generated at the considered stage (discarded products, materials, etc.) until the end-of-waste state is reached according to the Polluter pays principle.

When applying the benefits and loads beyond the system boundaries stage (Module D), refer to paragraph 2.2.8.

The manufacture and end of life of some components may be included in other stages of the reference product's life cycle. For example, in the installation stage, it is possible to find the manufacture of components that are installed with the reference product and that have not been considered in the Manufacturing stage, because these components are not delivered with the reference product. Similarly, end-of-life packaging may be treated in the installation stage of the product and not in the end-of-life stage.

2.2.2. Stages to be included

The environmental information included in the PEP shall cover all the stages of the life cycle ("cradle to grave"). Therefore, the life cycle shall be divided into the following stages:

- Manufacturing stage: from the extraction of natural resources to product and packaging manufacturing and their delivery to the manufacturer's last logistics platform,

- Distribution stage: transportation from the last manufacturer's logistics platform to the arrival of the product at the place of use and production of reconditioning packaging[7],
- Installation stage: installation of the product at the place of use,
- Use stage: use of the product and maintenance necessary to ensure the ability for use,
- End-of-life stage: removal, dismantling and transportation of the end-of-life product to a treatment centre or landfill site, and the end-of-life treatment,
- Net benefits and loads beyond the system boundaries stage (module D as presented in 2.2.8): potential for reuse, recovery and/or recycling, expressed as net benefits and impacts. This stage is optional.

The details of the processes allocated to each stage shall comply with paragraphs 2.2.4 to2.2.8. Throughout the present document the modules provided in the EN 15804:2019+A2 could be used to describe the life cycle stage (see modules details in Figure 4 of the Appendix B). The detailed diagram of the scope of the LCA is given in Figure 3 in Appendix B.

2.2.3. Manufacturing stage

The inputs and outputs related to the following aspects shall be included in the manufacturing stage:

1. Production of the materials and components making up the reference product and assembly:
    - Production (extraction, treatment, transformation, etc.), transportation and packaging of raw materials necessary to manufacture the components, including the flows associated with the waste and discarded materials generated by the manufacturing processes up to their end-of-waste status or disposal of final residues,
    - Industrial transformation and manufacturing processes of the various parts, components, and products,
    - Transportation of materials, components and subassemblies from the supplier's production site to the assembly site(s) and/or packaging site(s).
2. Production (extraction, treatment, transformation, etc.) of packaging raw materials and transportation of the packaging from its manufacturing site to the product packaging site. The packaging scope to be considered is that of the primary packaging[8]: packaging that contains and protects the product (box, plastic film, etc.) and the secondary packaging (grouping and transport packaging systems such as

[7] Occurring at manufacturer's sites.

[8] European Directive 94/62/EC on packaging defines the primary packaging as being the packaging conceived so as to constitute a sales unit to the final user or consumer at the point of purchase.

grouping cardboard boxes, wooden pallets and plastic films). It shall include the reference product packaging and the product manuals and labels, where applicable.

3. Industrial processes used to assemble the reference product and packaging components.
4. Transportation of the packaged product from the packaging site to the manufacturer's last logistics platform.

Manufacturing waste outputs shall be affected as co-products. Net benefits and loads (module D) allocated to co-product cannot be taken into account. If co-product allocation cannot be performed other chosen methods shall be justified. As such, net benefits and loads for A1-A3 modules shall not be declared.

2.2.4. Distribution stage

The inputs and outputs associated with the following aspects shall be included in the distribution stage:

1. Transportation of the product in its packaging from the manufacturer's last logistics platform to the distributor and from the distributor to the installation place.
2. Where appropriate, production, procurement and transportation of reconditioning packaging materials:
    - Production (extraction, treatment, transformation, etc.) of raw materials and procurement of the reconditioning packaging,
    - Transportation of the reconditioning packaging from the point of reconditioning to the place of use.
3. Where appropriate, end-of-life management of the product packaging materials leaving the last logistic platform up to their end-of-waste status or disposal of the final residues.

2.2.5. Installation stage

The processes, components and energy included in the installation stage shall be described and justified in the LCA report and described in the PEP. In particular, the installation stage shall include the flows (energy consumption, emissions, etc.) related to the installation process.

The inputs and outputs associated with the following aspects shall be included in the installation stage:

1. For all products generating waste when installed: upstream production and transport of the flow which generates this waste,

2. Manufacturing, packaging and procurement of materials and components not supplied with the reference product but required for its installation,
3. Installation processes,
4. Management of the waste generated at the installation place (collection and treatment up to its end-of-waste status, or disposal of the final residues):
    - Packaging,
    - Discarded installation materials,
    - Waste associated with the installation processes (for example, installed product scrap, individual protections specific to the installation of equipment and required by the manufacturer).

2.2.6. Use stage

The use stage of the reference product shall consider product operation under normal conditions of use[9].

The inputs and outputs associated with the following aspects shall be included in the use stage:

1. Energy consumption, water consumption, emissions and other flows of the product during its use over the reference service life (RSL),
2. Production, distribution, installation and end-of-life of elements required to operate, service and maintain the reference product over the RSL.
3. For connected devices, the inputs and outputs associated with the following aspects may be included in the use stage:
    a. Energy consumption
    b. Hardware impact

    associated with data transmission, management and storage on the telecommunication network and in the datacenters.

More details on the use stage scope are provided in Chap 2.5.4 and Chap 2.5.5.

Elements specified by the manufacturer and not supplied with the product shall be included (preventive and regulatory maintenance, wear parts, etc.).The breakdown of Module B (Modules B1 to B7 according to Figure 4 of the Appendix B) is optional, except for PEPs made within the French regulatory framework (refer to Appendix C of this PCR) and strongly recommended for PEPs whose systems are installed in Building. In this case, the assumptions for the calculation and the breakdown of the use stage can be specified in the PSRs for the product categories concerned.

[9] Technical requirements are satisfied by the product design regarding the intended application.

2.2.7. End-of-life stage

The inputs and outputs associated with the following aspects shall be included in the end-of-life stage:

1. Processes required for the deinstallation,
2. Transportation required to collect the end-of-life product and transport it from the installation site to the final treatment site,
3. Depollution,
4. Separation and preparation of fractions (e.g.: dismantling, crushing, shredding, sorting process),
5. Material recovery process (e.g.: metallurgical, chemical processes),
6. Energy recovery processes (e.g.: incineration with energy recovery, use as recovered solid fuel),
7. Disposal (e.g.: incineration without energy recovery, landfill).

System expansion is allowed at the end-of-life stage (i.e. environmental benefits from waste-to-energy recovery and recycling may be considered), according to the provisions of paragraph 2.2.8 of this document.

The breakdown of Module C (Modules C1 to C4 according to Figure 4 of the Appendix B) is optional, and strongly recommended for PEPs whose systems are installed in Building. In this case, the assumptions for the calculation and the breakdown of the end of life stage can be specified in the PSRs for the product categories concerned.

2.2.8. Net benefits and loads beyond the system boundaries stage (optional)

The net benefits and loads beyond the system boundaries may also be included in the PEP. It is referred to Module D across this document, moreover it shall be reported for PEPs made within the French regulatory framework (refer to Appendix C of this PCR) and strongly recommended for PEPs whose systems are installed in Building. This stage corresponds to the potential for reuse, recovery and/or recycling, expressed as net benefits and impacts. The inclusion of this stage is optional.

The inputs and outputs associated with the following aspects shall be included in the net benefits and loads beyond the system boundaries stage:

1. Impacts prevented by recycling the material,
2. Impacts prevented by waste-to-energy recovery,
3. Environmental impact of the production of the recycled material of the product, not taken into account during the manufacturing stage.

The net benefits and loads beyond the system boundaries are calculated using the following formulas described in Annex G of the EN 50693 (Table G.3 — Adaption of the Circular Formula and parameters for the application in context of "Case C: With net benefits"):

Stage	Associated module	Formulas	
Production	Modules A1-A3, A4, A5, B1-B7 and C1-C2	Impacts related to primary materials input	$\sum_{i=1}^{n}(1 - R_{1(i)}) \times M_i \times E_{PM(i)}$
		Impacts related to secondary materials inputs	$\sum_{i=1}^{n} R_{1i} \times M_i \times E_{MR\ after\ PS\ i}$
End of life	Module C3	Impacts related to material recovery operations at end of life	$\sum_{i=1}^{n} R_{2i} \times M_i \times E_{MR\ including\ PS\ i}$
		Impacts related to energy recovery operations at end of life	$\sum_{i=1}^{n} R_{3i} \times M_i \times E_{ER\ including\ PS\ i}$
	Module C4	Impacts related to disposal operations at end of life	$\sum_{i=1}^{n}(1 - R_{2i} - R_{3i}) \times M_i \times E_{Di}$
	Module D	Net avoided impacts related to materials/energy output at end of life	$\sum_{i=1}^{n}(-R_{2i} \times M_i \times E^{*}_{PM\ i} - R_{3i} \times M_i \times E_{SE\ i} + R_{1i} \times M_i \times E_{PM\ i})$

Table 1: formulas for calculating the net benefits and loads beyond the system boundaries

R_{1i}: it is the proportion of material I in the input to the production that has been recycled from a previous system.

R_{2i}: it is the proportion of the material i in the product that will be recycled in a subsequent system. R2i shall therefore take into account the inefficiencies in the end-of-life processes and be measured at the output of the recycling plant.

R_{3i}: it is the proportion of the material i in the product that is used for energy recovery at end of life.

M_i: weight of the material i.

E_{PMi}: inputs and outputs (by analysis unit) from the production (extraction, treatment, transformation, etc.) of virgin material.

$E_{MR\ including\ PSi}$: material recovery inputs and outputs (by analysis unit) from collection to point of substitution. The process where the substitution takes place is included.

$E_{MR\ after\ Psi}$: material recovery process inputs and outputs (by analysis unit) after the point of substitution. The process where the substitution takes place is not included.

$E_{ER\ including\ PSi}$: inputs and outputs (by analysis unit) of energy recovery processes (e.g. incineration with energy recovery, or landfill with energy recovery) from collection to point of substitution. The process where the substitution takes place is included.

E_{Di}: material i disposal inputs and outputs (by analysis unit), without energy recovery.

E^*_{PMi}: inputs and outputs (by analysis unit) from production (extraction, treatment, transformation, etc.) of the virgin material substituted by hypothesis by the recyclable material i. The quality of this material may be equivalent to that of the input material i or of lower quality.

E_{SEi}: inputs and outputs (by analysis unit) that would have resulted from the specific energy source substituted by the quantity of recovered material i, intended for energy recovery (heat or electricity).

R1i, R2i and R3i proportion should use specific data that could be given in the PSRs. If no data available, the default values provided in Annex D shall be used (based on Table G-4 of the EN 50693 — Default values for R1, R2 and R3 to be apply in case of the lack of specific data).

NOTE: This formula reflects that, when more secondary materials are used than are produced, then virgin production has to be brought into the market to "reload" the material loop in a context of stable or high-growth end material (virgin and recycled) volume.

As mentioned in Chap 2.2.1, all waste treatment and disposal processes shall be considered until the end-of-waste state is reached according to the Polluter pays principle. The following diagram is providing indication of when the end of waste occurs:

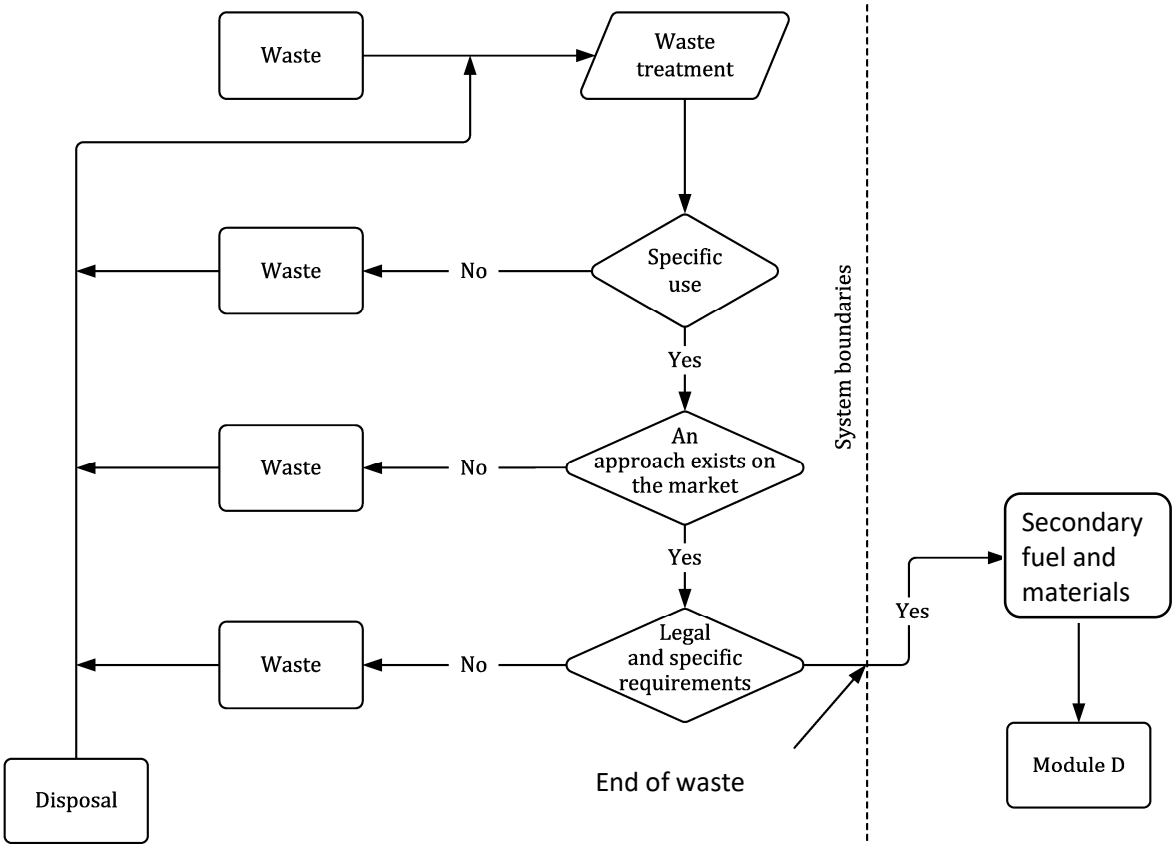


Figure 2: End waste decision tree

The end-of-waste state can but shall not equal the point of substitution and basically defines the boundary between the product system (modules A, B, C) and supplementary information in module D, where all potential benefits and avoided loads are summarized

The point of substitution shall be identified when the module D is declared in order to apply the formulas described in Table 1. The point of substitution corresponds to the point in the recovery chain where the primary materials are replaced by the secondary materials. The modeling of this stage complies with the requirements of EN 50693 according to the position of the point of substitution (PSi) and with the calculations provided in the AFNOR CN/EN 15804+A2.

NOTE: In the context of using ECOSYSTEM public LCI datasets (France scope), as the point of substitution is associated with the availability of the transformable material, there are zero impacts to be taken into account during the manufacturing of the recycled material. Only transport or other supplementary processes after the point of substitution need to be considered. The impacts of the manufacturing of the recycled material are therefore taken into account in the calculation of net benefits and loads beyond the system boundaries. The ECOSYSTEM LCI datasets are available at: http://weee-lci.ecosystem.eco/Node/. An example of calculation of Module D is available in Appendix D.

2.2.9. Exclusions from system boundaries

All assessable input and output flows within the scope of the analysis shall be included.

However, the following flows are conventionally excluded from the analysis, due to the difficulty in allocating them to a particular reference flow:

- Lighting, heating, sanitary facilities and infrastructure cleaning[10],
- Employee transport, apart from transportation for product maintenance purpose,
- Manufacture and maintenance of the manufacturing facility and machines if they are not proportional to the reference flow,
- Construction and maintenance of the infrastructure[9] if they are not proportional to the reference flow,
- Transport systems and infrastructures if they are not proportional to the reference flow,
- Administrative, management and R&D department flows,
- Marketing activity related to the product,
- Staff catering facilities.

The following processes are also excluded, because the professionals in the sector have recognized their limited impact:

- Clipping,
- Screwing,Press fitting of parts.

If any flow, process or element is not proportional to the reference flow, its impact is not allocated to the reference flow in the case it is negligible (less than 5% in mass, energy and environmental contribution) compared to the product (scale of the production series).

Additional exclusions, different from cut-off criteria may be defined in the PSRs and provided that they are justified, as in the case of non-quantifiable flows.

[10] Production unit, logistics platform, transformation plant, administrative building, etc.

2.3. Cut-off criteria

As mentioned in paragraph 2.2.1, all assessable inputs and outputs within the scope of the analysis shall be included:

- Either by collecting primary data that may be used to trace back to the elementary flows, when such data are available,
- Or, with secondary data from Life Cycle Inventory datasets (LCI datasets) or documented scientific models.

The following cut-off criteria shall be applied by default:

- The mass of intermediate flows not taken into account shall be less than or equal to 5% of the mass of the elements of the reference product corresponding to the functional unit,
- The energy flows not taken into account shall be less than or equal to 5% of the total use of primary energy during the life cycle of the reference product corresponding to the functional unit,
- The environmental impacts not taken into account shall be less than or equal to 5% of the total environmental impacts generated during the life cycle of the reference product corresponding to the functional unit.

The cut-of rules cannot be used in order to hide significant impact. In order to operationally understand this last cut-off criterion, the following materials and components shall systematically be included in the reference product modeling (the energy and mass cut-off criteria do not apply for the elements on this list). The list below is not complete.

Materials	Components
Gold	Microprocessors
Silver	Magnesium anode
Copper and alloys	Tantalum capacitor
Antimony trioxide[11]	Arsenic-Gallium capacitor
Insulating gas (e.g.: SF6)	Batteries and storage cells
Coolants	
Rare earths: Indium, Molybdenum, Neodymium	

Table 2: Materials and components to be taken into account in the modelling

If necessary, PSRs should define more conservative cut-off criteria, in particular by completing the list of materials and components.

2.4. Rules for allocation between co-products

Most industrial processes produce more than one product. Usually, more than one input is needed to produce a product and sometimes the products are co-produced with other products.

In production systems with co-products, the subdivision - i.e. the allocation rules for distributing the inputs and outputs to each of the products - shall be defined and described in the LCA report (see paragraph 3 for the LCA report content).

Where allocation cannot be avoided, the allocation procedures shall follow the requirements provided in paragraph 4.3.4 of ISO 14044.

To partition the consumption of energy, materials and water and the emissions to air, water and soil, as well as waste, a relevant allocation rule (physical, monetary, etc.) that best describes the functioning of the systems shall be applied.

Examples of the physical parameter used to allocate input and output flows are the mass, area or unit quantity produced, as appropriate to the production system (production of materials and parts, product assembly).

[11] Additive used in plastics.

If the physical parameter cannot be used, the allocation shall be based on economic aspects, such as working hours, operating hours or production cost.

Allocation rules can be defined in the PSRs if necessary.

2.5. Development of scenarios (default scenarios)

2.5.1. General

The scenarios to be used for the different life cycle stages are described in the PSRs for a product category.

If no PSR is available for a given product category, or if the PSRs do not provide information on a specific life cycle stage, the scenarios described in the following paragraphs shall be used and shall be documented in the LCA report. They shall also be mentioned in the PEP.

The reference scenario shall also be mentioned in the PEP if required by the PSR.

2.5.2. Electricity consumption scenario

For all the life cycle stages, electricity consumption shall be representative of the geographical area of the stage. If the geographical area of the stages beyond the factory gate (B1-7, C1-4 and D modules) can be defined, national representative energy mix shall be applied.

The elements used must be specified and justified in the LCA report. The energy mix used must be indicated in the PEP.

2.5.3. Transport scenarios

Transport-specific data should be taken into account for transportation stages (kilometres covered, types of transport). Data shall be justified and documented in the LCA report.

If no specific data are available, the following by default data are taken into consideration for all the stages, from manufacturing to end-of-life:

- International transport: 19,000 km by boat plus 1,000 km by lorry,
- Intracontinental transport: 3,500 km by lorry,
- Local/domestic transport: 1,000 km by lorry.

By default, an articulated-lorry >27t is used with a loading rate is 85%. If the loading rate is not specified in the LCI dataset, it must be indicated in the LCA report and the PEP.

Where special means of transport or unladen return journeys are required, they must be taken into consideration.

2.5.4. Reference product use scenarios

The scenario definition shall consider the following elements when they exist:

- Regulations applicable to product categories (e.g. execution measures adopted under ERP[12] directives, etc.),
- Standards or harmonized standards,
- Recommendations from manufacturers or manufacturer organizations,
- Use agreements established by consensus in sector-specific working groups.

The use scenario applied shall define at least:

- The reference service life (RSL),
- The load factor, frequency,
- Key use assumptions (for example: % use rate during the RSL),
- Leakage rate when relevant (fugitive emissions of gas).

The aforementioned criteria shall enable the consumed and/or dissipated energy and other flows (emissions, water, etc.) to be measured, according to the product category.

If products are subject to product-specific rules (PSRs) that define an RSL, the declaring party shall apply it.

If products are not covered by product-specific rules (PSR), the use scenarios shall be justified in the LCA report and the PEP shall mention at least:

- The reference service life (RSL),
- The load factor, frequency,
- Key use assumptions (for example: % use rate during the RSL),
- Leakage rate when relevant (fugitive emissions of gas).

2.5.5. Maintenance scenarios

For products not covered by a specific PSR rule, and when legislation requires maintenance inspections, the specific frequency of the inspections mentioned in the legislation shall be applied. A transportation distance of 100 km roundtrip for 1 person (assumed weight 80 kg) may be taken into account, specifying the LCI dataset used, the transportation means (e.g. Utility vehicle) shall be specified.

The operating, servicing and maintenance conditions, as specified by the manufacturer shall include:

- The maintenance operation frequency where applicable,
- Fugitive emissions occurring during operations (refrigerant gas, insulating gas…),

[12]Directive 2009/125/EC of the European Parliament and the Council of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products.

- The parts, products and solvents used to maintain/service the reference product: batteries, light sources and any substance covered by a Material Safety Data Sheet,
- The consumables required for operation: ink for the printers, etc.

Other distance data used for transport shall be described and justified in the LCA report.

2.5.6. End-of-life treatment scenarios

The following treatment scenarios shall be considered for all elements that reach end of life during the life cycle and documented in the LCA report:

1. Product/material disposal processes (incineration without waste-to-energy recovery, landfill):
    - If the product disposal treatment is known and/or the data are available, the impacts related to these processes shall be taken into account. The types of treatment used shall be described and documented in the LCA report,
    - If the distance to the disposal site is not known or is not included in the end-of-life data, transport of the product by lorry of 1,000 km with a loading rate of 85% shall be taken into account by default.
2. Product/material recovery (reuse, recycling or incineration with waste-to-energy recovery):
    - In this case, the end-of-life treatment does not lead to waste disposal,
    - If the distance to the recovery site is not known, transport of the product by lorry of 1,000 km with a loading rate of 85% shall be taken into account by default.

When these operations apply according to the product's end-of-life scenario, they must be modelled to reflect the following key parameters specified in EN 50693:

Operation/process	Key parameters
Collection, transport, storage	Distance in km between the collection point and the treatment installations; collection and transport means, Capacity and loading rate for road transport, Unladen return rate, Direct emissions caused by the degradation of products.
Depollution, separation of fractions and preparation	Energy type and quantity, Other services and consumables (e.g.: nitrogen), Direct emissions of pollutants and particles, Emissions in the air or in water (including discharges).
Recycling, recovery of other materials, waste-to-energy recovery and disposal	Energy type and quantity, Other services and consumables (e.g.: nitrogen), Direct emissions of pollutants and particles, Emissions in the air or in water (including discharges), Nature of the material/energy substituted and the associated rate of substitution.

Table 3: Key parameters of the end-of-life processes to be taken into account in the LCA according to EN 50693

The end-of-life scenario shall be representative of the geography in which the product is treated, deviation shall be justified. End of Life scenarios may be defined more precisely in the PSR. If no data is available, the default values provided in the Annex G of the EN 50693 (Table G.4 — Default values for R1, R2 and R3 to be apply in case of the lack of specific data) could be used.

If the treatment is unknown or the data are not available, transport of the end-of-life product by lorry of 1,000 km with a loading rate of 85% shall be taken into account by default, as well as disposal in a landfill for each family of identified waste materials. The scenario used must then be justified in the LCA report and indicated in the PEP.

NOTE 1: The constituent material of an electronic circuit board is considered to belong to the plastics family, which is the least beneficial case.

NOTE 2: the waste flows shall be modelled up until the end of waste status.

NOTE 3: 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. However, for solid waste disposal of products containing biogenic carbon declared as GWP-biogenic (chapter 2.10.1), the degradation of a product's biogenic carbon content in a solid waste disposal site, declared as GWP biogenic, shall be calculated without time limit. Any remaining biogenic carbon is treated as an emission of biogenic CO2 from the Technosphere to nature.

NOTE 4: end of life scenarios could be set to 100% and reported as additional information, moreover additional circularity indicators, such as recyclability rate, could be declared in additional information as well.

2.5.7. Scenario for considering net benefits and loads beyond the system boundaries

The benefits and loads could apply at the product end of life or during other life cycle stages (installation elements, etc.) but manufacturing stages.

NOTE: to calculate net benefits and loads beyond the system boundaries (France scope), ECOSYSTEM public LCI datasets are recommended, during the use of PEPs within the French regulatory framework.

2.6. Rule(s) for extrapolation to a homogeneous environmental family

The PEP may cover products other than the reference product.

These products shall be mentioned in the PEP and in the LCA report, provided that they belong to the same homogeneous environmental family as the reference product. To belong to a homogeneous environmental family, the group of products shall have the following characteristics:

- Same main functionality,
- Same product standards,
- Similar manufacturing technology: same type of materials and manufacturing processes.

If the environmental data - material balance or environmental impacts - differ from those of the reference product, the extrapolation rule(s) allowing the data to be estimated at every stage of the life cycle shall be used.

Extrapolation rules may be defined in the specific rules (PSR). In this case they can be directly applied. These rules are established on the basis of different product LCA and justified and documented in the PSRs. In addition, they are verified during the third-party review of the PSRs.

If no rules are set in the PSRs, the following stages shall be followed to define extrapolation rule(s):

- Analyse the products covered by the PEP belonging to the same homogenous family,
- Perform the LCA of representative products of the homogeneous family[13],
- Identify and quantify the product parameters that vary between the various products of the homogeneous environmental family (i.e. dimensions, weight of parts, materials,

[13] Representativeness could be defined either as a median product in term of feature (e.g. a 5kW product for a range spanning from 1 to 10kW) or as market representative (e.g. best seller of a product range on a given market).

energy consumption, etc.) and conduct a sensitivity analysis to identify influential parameters.

This process shall be documented in the LCA report, and the extrapolation rules must be indicated in the PEP.

NOTE: the sensitivity analysis conducted to identify the influential parameters (e.g. product mass, power range, transportation distance…) should be undertaken for the potential highest and lowest environmental footprint products from the homogenous family (estimated from LCA of the representative product), together with a median product (if different than the representative product of the homogenous family).

2.7. Rules applying to joint environmental declarations

A joint environmental declaration shall meet the following conditions. It shall:

- Apply to a "standard product",
- Be based on the homogeneity of the parameters that significantly influence the value of each of the environmental indicators[14],
- Include a framework of validity that incorporates the following information:
    - The identification of the influential parameters, while specifying whether they are sourced from secondary or primary data,
    - The intervals of validity of these parameters.

This information shall be justified and documented in the LCA report.

Appendix A, which includes a sample definition of a framework of validity, may be used.

2.8. Units

SI units shall be used. Basic units are: metre (m), kilogram (kg), molecular weight in grams (mol). With the exceptions noted below, all resources are expressed in kg.

Exceptions are:

- Resources used for energy input (primary energy), which are expressed as kWh or MJ, including renewable energy sources e.g. hydropower, wind power,
- Water use, which is expressed in m3 (cubic metres),

[14] Influential parameters could be identified based on a flow analysis during the results interpretation.

- Temperature, which is expressed in degrees Celsius,
- Time, which is expressed in practical units depending on the assessment scale: minutes, hours, days, years,

For impact indicator results, only the units defined in paragraph 2.10 shall be used.

2.9. Environmental data requirements

2.9.1. Primary data collection requirements

All assessable input and output flows within the scope of the analysis shall be included.

For each unit process within the system boundaries, inputs and outputs related to the reference flow shall be collected including:

- Consumption of materials, energy, water,
- Emissions to air, water, soil,
- Waste from the processes analysed. Waste shall be classified, and the classification method documented in the LCA report.

In addition to the requirements above, the following recommendations shall be applied:

- The collected flows shall be averaged over a sufficiently long period, preferably over a year, to even out any seasonal peaks,
- The collected data shall be representative of a current scenario in terms of geographical coverage and technological coverage. When data are collected from several sites, the data shall be collected from representative sites[15]. The method used to aggregate the multi-site data (i.e. measurements taken on each site) and the rules applying to the creation of data sources shall be documented in the LCA report,
- The method of allocation to the reference flow shall be documented in the LCA report,
- Any deviations or missing data (data not available on all sites) shall be clearly identified and the rules for processing this missing data documented in the LCA report.

There is no need to collect information on noise or odour pollution and on the use of space due to the difficulty to characterize them. Information concerning noise or door pollution can nevertheless be mentioned in the paragraph dedicated to additional information.

2.9.2. Secondary data requirements

[15] For joint declaration, some guidance for sampling representativeness are available in Appendix A.

When primary data are not available, secondary data should be used for the processes included in the system boundaries. Secondary data shall be identified and consistent with the scope of the study in terms of temporal, geographical and technological representativeness.

In order to evaluate secondary data coverage and consistency with the scope of the study, and for the purpose of transparency and traceability, secondary data for which time-related, geographical and technological coverage is available shall be used and listed in the LCA report. If such coverage is unavailable, qualitative assessments shall be provided in the LCA report. Also, the rules used for adapting secondary data to be consistent with the scope of the study shall always be clearly described in the LCA report.

In addition to the program requirements mentioned above, secondary data should be selected from one of the sources below, in descending order of priority:

1. LCI datasets checked by independent experts with a data quality indicator (*DQR – Data Quality Rating*) defined according to paragraph 2.9.3.
2. LCI datasets that have been checked by independent experts attesting to their conformity with this PCR.
3. LCI datasets that have been checked by the PEP developer attesting to their conformity with the PCR.
4. LCI datasets based on LCA studies compliant with ISO 14040 and 14044 standards or any other reference document referring to these standards and independently verified.
5. LCI datasets that have been pre-checked by the data supplier attesting to their conformity with this PCR.
6. LCI datasets with no proof of verification. In this case, the LCA report shall justify the selection of this dataset.

NOTE: For the six criteria mentioned above, the most up-to-date LCI datasets should be used, considering the same coverage (representativeness).

2.9.3. Evaluation of data quality and characteristics

For all the unit processes included in the system boundaries, the quality of primary and secondary data shall be assessed in the LCA report. In accordance with ISO 14044, data quality requirements should address the following aspects:

- Time-related coverage: age of data and the minimum length of time over which data should be collected,
- Geographic coverage: geographical area from which data for unit processes should be collected to satisfy the goal of the study,
- Technology coverage: specific technology or technology mix,
- Precision: measure of the variability of the data values for each data expressed (e.g. variance),

- Completeness: percentage of flow that is measured or estimated,
- Representativeness: qualitative assessment of the degree to which the data set reflects the true population of interest (i.e. geographical coverage, time period and technology coverage),
- Consistency: qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis
- Reproducibility: qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study,
- Sources of the data,
- Uncertainty of the information (e.g. data, models and assumptions).

The data quality of each relevant secondary datasets and life cycle inventories used in the PEP shall be calculated and documented in the LCA report.

Relevancy is defined as data contributing to at least 80% of the reference indicators[16] on the whole life cycle of the product (module D contributions not included). When applicable, module D data quality shall be evaluated as well.

In order to calculate the secondary datasets quality, the Data Quality Rating (DQR) provided in the Product Environmental Footprint Guide, version 6.3 could be used. The DQR calculation is based on 3 data quality criteria (DQR – *Data Quality Rating*)[17]:

$$DQR = \frac{Ter + GR + TiR}{3}$$

Where TeR is the Technological-Representativeness, GR is the Geographical-Representativeness, and TiR is the Time-Representativeness. The representativeness (technological, geographical, and time-related) characterises to what degree the processes and products selected are depicting the system analysed. The quality criteria value shall be assigned based on Appendix E, value spans from "1" to "5", "1" being the best quality and "5" the worst.

DQR of 5 shall be taken as a conservative assumption when no secondary datasets quality assessment is possible.

The secondary data quality indicator and version could be supplied by the secondary data publishers (e.g. LCA database providers). If necessary, this data should be adjusted to reflect the individual

[16] The reference indicators for the scope of PEP Ecopassport are: total global warming, abiotic resource depletion – mineral, eutrophication, use of total non-renewable primary energy, and non-hazardous waste disposal

[17] Precision criteria has been removed from the initial DQR formula since not relevant for the secondary data quality calculation (PEF Guide version 6.3, Chapter 7.19.2.2).

analysis (for instance to correct the geographical representativeness of the secondary dataset selected).

The data shall be recent. The data used for the calculations shall be based on data averaged over one year. Additional to the TiR criteria from the DQR, the secondary datasets should have been updated over the last 10 years and over the last 5 years for primary data with producers. If this is not the case, justify the data used in the LCA report.

The period during which the system inputs and outputs shall be taken into account is 100 years from the year for which all the data is considered as representative. A longer period should be used if relevant.

The global secondary data quality level may be evaluated according to the table provided in Chap 3.4.1.

2.10. Environmental impact calculation

The selection of indicators by the program is based on the level of international recognition and takes into consideration the specific nature of the production of electrical, electronic and HVAC-R equipment and the requirements of other industry sectors, such as the European construction industry.

The indicators selected by the program are classified into two categories:

- a common base of mandatory indicators,
- optional indicators that companies are free to choose and declare.

The EC-JRC characterization factors in EN 15804:2019+A2 shall be applied. The characterization factors are accessible via the EC JRC website.

The impact results shall correspond to the sum of the characterized flows.

The impact categories and indicators are specified below and LCIA methods are provided in Appendix G of this document.

2.10.1. Common base of mandatory indicators

The parameters and units to be selected are:

- Environmental impact indicators:
    - Climate change - total, expressed in kg CO_2 eq.
    - Climate change - fossil fuels, expressed in kg CO_2 eq.
    - Climate change - biogenics, expressed in kg CO_2 eq.
    - Climate change - land use and land use transformation, expressed in kg CO_2 eq.
    - Ozone depletion, expressed in kg CFC-11 eq.

- Acidification (AP), expressed in mole of H+ equiv.
- Freshwater eutrophication, expressed in kg P eq.
- Marine aquatic eutrophication, expressed in kg of N equiv.
- Terrestrial eutrophication, expressed in mole of N equiv.
- Photochemical ozone formation, expressed in kg of NMVOC equiv.
- Abiotic resource depletion - elements or resource depletion - metals and minerals, expressed in kg Sb eq.
- Abiotic resource depletion - fossil fuels or resource depletion - fossils, expressed in MJ[18].
- Water requirement expressed in m^3 of equiv. deprivation worldwide.

- Inventory flows indicator:
  - Resource use indicators
    - ✓ Use of renewable primary energy, excluding renewable primary energy resources used as raw materials, expressed in MJ,
    - ✓ Use of renewable primary energy resources used as raw materials, expressed in MJ,
    - ✓ Total use of renewable primary energy resources, expressed in MJ,
    - ✓ Use of non-renewable primary energy, excluding non-renewable primary energy resources used as raw materials, expressed in MJ,
    - ✓ Use of non-renewable primary energy resources used as raw materials, expressed in MJ,
    - ✓ Total use of non-renewable primary energy resources, expressed in MJ.
  - Indicators describing the use of secondary materials, water and energy resources (e.g. waste combustion):
    - ✓ Use of secondary materials, expressed in kg[19],
    - ✓ Use of renewable secondary fuels, expressed in MJ,
    - ✓ Use of non-renewable secondary fuels, expressed in MJ,
    - ✓ Net use of fresh water, expressed in m^3.
  - Waste category indicators
    - ✓ Hazardous waste disposed of, expressed in kg,
    - ✓ Non-hazardous waste disposed of, expressed in kg,
    - ✓ Radioactive waste disposed of, expressed in kg.
  - Output flow indicators:
    - ✓ Components for reuse, expressed in kg,
    - ✓ Materials for recycling, expressed in kg,
    - ✓ Materials for energy recovery, expressed in kg,

[18] Uranium is part of ADP fossil. PENRT = ADP fossil.

[19] This indicator includes the entire declared system (product, packaging, etc.).

- ✓ Exported energy, expressed in MJ.

- Other indicators[20]:
  - ✓ Biogenic carbon content of the product, expressed in kg of C,
  - ✓ Biogenic carbon content of the associated packaging, expressed in kg of C.

NOTE: for declarations made within the French regulatory framework, refer to the indicators listed in Appendix C.

2.10.2. Optional indicators

The parameters and units to be selected are:

- Environmental impact indicators:
  - Total use of primary energy during the life cycle, expressed in MJ,
  - Emission of fine particles, expressed in incidence of diseases,
  - Ionizing radiation, human health, expressed in kBq of U235 equiv,
  - Ecotoxicity (fresh water), expressed in CTUe,
  - Human toxicity, carcinogenic effects, expressed in CTUh,
  - Human toxicity, non-carcinogenic effects, expressed in CTUh,
  - Impacts related to land use/soil quality, without dimension.

3. LCA report

3.1. General

A LCA report shall be made available to the authorized auditor to demonstrate that the analysis complies with the rules in this document.

It shall contain the information described in paragraphs 3.2 to 3.7 regarding:

- General information,
- Reference flow and the functional unit,
- Life cycle inventory,
- List of elementary flows,
- Environmental impacts,

[20] These indicators may be declared void for items of equipment that are covered by the program and which are not concerned.

- Additional environmental information.
- Interpretation of the results, including hotspots identification, limitations and recommendations. Interpretation may be required to align with international standards such as the ISO 14067:2018. Appendix F is providing requirements to follow in order to have a PEP compliant with the ISO 14067:2018 standard.

NOTE: The company is free to choose formal or graphical aspects.

The content of the LCA report is described in the last updated version of the document entitled "LCA report content" (AP0012) available from the PEP Ecopassport® program website.

3.2. General information

The LCA report shall indicate:

- The date of the report,
- The name of the persons/agents who drew up the report,
- The name of the product,
- Identification of the product (e.g. reference number) and products covered by the PEP,
- The version of the PCR applied,
- The version of the PSR applied, where appropriate,
- The identification of the LCA report,
- Date of publication and its validity period,
- Purpose of the study: reasons for carrying out the study as well as its application and target audience[21].

3.3. Reference flow and functional unit

The LCA report shall indicate:

- The reference flow as defined in paragraph 2.1,
- The product category (reference to the applicable PSRs),
- The description and justification of the functional unit (e.g.: standards fulfilled by the reference product, test reports),

[21] Example of targeted audience: "The publication of PEPs is intended for communication between companies via the PEP Ecopassport platform".

- The reference service life and its justification when no PSR is available,
- Where applicable:
  - The description of the declared unit. If the declared unit does not correspond to the sales unit, justify the choice,
  - The products from the same homogeneous environmental family as the reference product,
  - The extrapolation rule(s) used to estimate the environmental impacts of the products from the reference product. The rule(s) are described, justified and documented,
  - The list of entities entitled to claim a joint environmental declaration.

3.4. Life cycle inventory

3.4.1. Data sources

The LCA report shall indicate the source of the LCI datasets used and the data used for the calculation (e.g.: database editor, database version, and data list).

For specific LCI datasets used for the LCA, attach the specific LCA reports or the information necessary to access them.

For all life cycle stages, the list of intermediate flows that have not been considered in the analysis due to the lack of LCI datasets shall be reported in the LCA report.

The data quality of each relevant secondary datasets and life cycle inventories used in the PEP shall be calculated and documented in the LCA report.

Relevancy is defined as data contributing to at least 80% of the reference indicators[22] on the whole life cycle of the product (module D contributions not included). When applicable, module D data quality shall be evaluated as well.

In order to calculate the secondary datasets quality, the Data Quality Rating (DQR) provided in the Product Environmental Footprint Guide, version 6.3 and detailed in Chapter2.9.3 could be used.

If the data is not available, by default the DQR is equal to 5. The secondary data quality level may be evaluated according to the table below (PDF Guidance version 6.3):

Global evaluation of the data quality (DQR)	**Global data quality level**
DQR ≤ 1.5	Excellent quality

[22] The main environmental indicators for the scope of PEP Ecopassport are: total global warming, abiotic resource depletion – mineral, eutrophication, use of total non-renewable primary energy, and non-hazardous waste disposal

1.5 < DQR ≤ 2.0	Very good quality
2.0 < DQR ≤ 3.0	Good quality
3 < DQR ≤ 4.0	Satisfactory quality
DQR > 4	Poor quality

Table 4: Global secondary data quality level

Evaluation could be supported by the table available in Appendix E.

3.4.2. Life cycle stages

The LCA report shall specify the compliance with mass and energy cut-off criteria and environmental impacts, according to paragraph 2.3 of this PCR.

The additional provisions by life cycle stage are specified in the following paragraphs.

3.4.2.1. Manufacturing stage

The LCA report shall:

- Clearly identify and quantify (e.g. mass, etc.) each material, component and process used to produce the reference flow, as well as the corresponding dataset used,
- Identify and justify any approximations or exclusions of materials, components or processes,
- Indicate the justification for the mass and the energy consumption to verify the cut-off criteria,
- Identify the transport data for the raw materials to the manufacturing site and the reference flow to the manufacturer's final logistics platform, as well as the corresponding datasets used,
- Indicate clearly, describe and justify if any transport scenarios other than those indicated in paragraph 2.5.3 of this document are used,
- Identify the waste treatments of output flows (e.g. treatment of production losses) from the manufacturing site as well as the corresponding datasets used,
- Indicate that the collected data shall be representative of a current scenario in terms of geographical coverage and technological coverage. When data are collected from several sites, the data shall be collected from representative sites. The method used to aggregate the multi-site data (i.e. measurements taken on each site) and the rules applying to the creation of data sources.

Finally, a flowchart representing the manufacturing stage may be added.

3.4.2.2. *Distribution stage*

The LCA report shall indicate the transport scenarios from the manufacturer's last platform to the site of use and the corresponding dataset used. If any transport scenarios other than those described in paragraph 2.5.3 of this document are used, it shall be clearly indicated, described and justified (i.e. internal statistics on transport).

3.4.2.3. *Installation stage*

The LCA report shall:

- Clearly identify and quantify (e.g. mass, volume, number, etc.) each component, process (including potential waste treatments) and type of energy required to install the product and the corresponding datasets used,
- Identify the waste management treatment of packaging,
- Identify and justify any approximations or exclusions of components, processes or energy flows.

3.4.2.4. *Use stage*

The LCA report shall:

- Clearly identify product operating modes,
- For each product operating mode, indicate the considered assumptions (use rate, energy consumption, current, etc.),
- If the product is covered by a standard or regulation that defines an energy consumption measurement method, clearly identify it (e.g. ErP performance measurement, thermal regulations, etc.),
- Indicate the geographical area, the energy models chosen, and the corresponding datasets used,
- Clearly identify and quantify (e.g. mass, volume, number, etc.) the elements required to operate, service and maintain the product (e.g. refrigerant gas leakage rate, water consumption, technician transportation…) and the corresponding datasets used,
- Identify and justify any approximations or exclusions.

If no PSR exists for the product category, the use scenario shall be based on existing standards or regulations, or, by default, on experimental measurements (best-known operating conditions, protocol used and measurements results shall also be included in the report). This shall be indicated in the LCA report.

3.4.2.5. *End-of-life stage*

The LCA report shall:

- Indicate, describe and justify the transport scenarios and the corresponding datasets used,

- Describe the product end-of-life scenario and the corresponding datasets used,
- Identify and justify any approximations or exclusions of any stage of the end-of-life scenario.

3.4.2.6. Net benefits and loads beyond the system boundaries stage (Module D)

If module D is declared, then the LCA report shall:

- Describe the scope concerned,
- Identify and justify any approximations or exclusions,
- Indicate the associated benefits and loads,
- Indicate, describe and justify the transport scenarios and the corresponding datasets used.

3.5. List of elementary flows

The LCA report shall include the list and units of elementary flows or the information required to access it (e.g.: actions required to access the system modelling in a LCA software).

The list of elementary flows shall be accessible during the entire period of PEP validity.

3.6. Environmental indicators

The LCA report shall indicate:

- The environmental indicators calculated, expressed as a numerical value in the corresponding unit with three significant figures (and optionally as a percentage) for each of the aforementioned life cycle stages and for the total life cycle,
- Where appropriate, the name and version of the software used if an LCA software application is used to calculate the impacts.

3.7. Additional environmental information

The LCA report shall justify all quantitative or qualitative information included in the PEP according to paragraph 4.3.

4. Drawing up the Product Environmental Profile

The PEP shall contain the information described in the following paragraphs regarding:

- General information,
- Constituent materials,
- Additional environmental information,
- Environmental impacts.

NOTE: The company is free to choose formal or graphical aspects.

4.1. General information

The editorial rules to be applied are in document AP0008 – Editorial rules - available from the PEP Ecopassport® program website. This document details the limitations to the use of the logo.

4.1.1. Name of the document

The term "Product Environmental Profile" and the "PEP Ecopassport®" logo (below) shall be included in the environmental declaration.

The logo is available on demand on PEP Ecopassport® website.

4.1.2. Information about the PEP Ecopassport® program

The information shall include:

- The registration number of the PEP in the program,
- The name and the address of the program, and if relevant, logo and website,
- The date of publication and the validity period,
- The identification of the applicable "Product Category Definition Rules" (PCR) document and its version,
- Where applicable, the identification of the "Product-Specific Rules" (PSR) document used and its version,
- The text: "Compliant with ISO 14025 on Type III environmental declarations",
- The text specified in ISO 14025: "The PCR review was conducted by an expert panel chaired by <name and organization of the chair of the review panel>",
- The text: "The content of this PEP cannot be compared with content based on another program",
- The verification text specified in ISO 14025: "Independent verification of the declaration and data, according to ISO 14025:☐internal ☐external"
- The auditor's accreditation number.

NOTE: A part of this information is described in the checklist title block presented in document AP0008 – Editorial rules - available from the PEP ecopassport® program website.

4.1.3. Company information

The company information shall include at least:

- The company details (name, web site),
- The details of a legal contact in the company (e.g. create a specific email address),
- Identify the location of the product's final assembly site(s). This information is not requested within the scope of joint declarations.

4.1.4. Reference product and methodology

The PEP shall indicate:

- The PEP reference product with a detailed description of its characteristics,
    - For example, "A 200-L thermodynamic water heater"
- An illustration of the reference product where appropriate,

- Information that unambiguously identifies the reference product: trade name, trade reference, etc.,
- The functional unit used to draw up the PEP,
- If applicable, the mathematical relation between functional unit and declared unit, if it is not mentioned in the PSR,
- The PEP declared unit, if necessary,
- Where appropriate:
    - The product category to which the product(s) belong(s),
    - In the event of a joint environmental declaration:
        - The list of eligible entities and the list of products studied,
        - The framework of validity: refer to Appendix A.

4.1.5. Homogeneous environmental families

The PEP may cover products other than the reference product.

In this case, the extrapolation rules established to estimate product-related data from the reference product and how they are to be applied (stage by stage), shall be stated in the PEP.

The format for the extrapolation rules must be described in the PEP from the following choices:

- A conservative approach (by taking the product with greater impact),
- A table by reference product with the calculation of the extrapolation coefficients,
- The extrapolation rule calculation formulas,
- Other format justified in the LCA report.

For example, the environmental impact extrapolation rule concerning the indicator for the depletion of the natural resources of the planet may be stated as: "The impacts of raw material depletion can be extrapolated to other products in the homogeneous environmental family by applying a rule of proportionality to the mass of the reference product".

4.2. Constituent materials

- The total mass of the reference product, packaging and additional elements supplied with the reference product by the manufacturer shall be indicated[23],
- For the following categories, indicate the percentage distribution of the total mass of the reference product, packaging and elements supplied with the reference product:
    - Plastics,

[23] For the French market, it is mandatory to provide the split of weights between principle product, packaging and additional elements if relevant, as presented in Appendix C.

    - Metals,
    - Other.
- For electrotechnical industry product, materials can be also further listed by material groups or by base materials as defined in IEC 62474:
    - Example of a material groups: copper and alloys, thermoplastics,
    - Example of base materials: copper, zinc, lead, polycarbonate, talc, dye.
- Beyond 15 material groups or basic materials, other materials shall be listed as one separated category named "Miscellaneous",
- Distribution data for materials shall be expressed as a % of the reference product mass with 1 digit after the decimal point and ranked in descending order of mass if it is presented in the form of a table,
- The materials shall cover the entire reference product, packaging and elements supplied with the reference product,
- The value of substances and materials with a mass lower than 0.1 % shall be given as "<0.1%",
- Plastics can be identified in conformity with the relevant current standards,
- Some components (e.g. electronic circuit boards, cells and batteries, fluorescent lamps) can be listed with their mass in the material balance without a description of the constituent materials, except for hazardous substances such as those listed in paragraph 4.3.2.

NOTE: for declarations made within the French regulatory framework, refer to the requirements presented in Appendix C.

4.3. Additional environmental information

4.3.1. General

Certain relevant aspects should be specified in the PEP according to ISO 14025 standard and the general instructions of the PEP Ecopassport® program following:

- Additional environmental information shall be specific, accurate and not misleading. It shall be based on information that is substantiated and verified, in accordance with the requirements of ISO 14020 and ISO 14021, clause 5,
- Additional environmental information shall only be related to environmental issues. It may include data on product performance, if environmentally significant. Information and instructions on product safety unrelated to the environmental performance of the product shall not be part of a Type III environmental declaration,

- Although the additional information cannot generally be related to a functional unit, it shall be provided for the same product as the product to which the environmental part of the declaration applies.

All additional environmental information shall be justified and documented in the LCA report. Furthermore, it shall be readily available on request and verifiable if it is disclosed:

- Where relevant, reference is made to recognized measurement methods defined in PSRs or to the standards in force,
- By default, measurement methods used to justify the additional environmental information shall rely on the test report documented in LCA report.

4.3.2. Manufacturing

Actions to reduce the environmental impact of manufacturing activities such as any environmental management systems or a regulatory monitoring system can be mentioned, with a statement on where an interested party may find details of the system.

The additional environmental information may include information on the absence or level of presence of a material considered to have an impact on the environment in certain areas [see ISO 14020 and ISO 14021, 5.7 (r)]. It shall not refer to the absence of substances or features that are not or have never been associated with the product category.

The hazardous substances specified in the various regulations or standards in force in the countries concerned and used in the composition of the reference flow can be mentioned as additional information[24].

If the quantity of a hazardous substance is indicated, it shall be expressed as specified by the regulations in force.

4.3.3. Distribution

Actions to reduce the environmental impact of the distribution stage, such as the establishment of specific logistic processes, can be mentioned.

4.3.4. Installation

Actions to reduce the environmental impact of the installation process can be mentioned.

[24] E.g. REACH, RoHS European regulations, others…

4.3.5. Use

Actions to reduce product pollution and its impact on the environment according to the characteristics of the reference product and consistent with the product use scenarios can be mentioned.

The following aspects can be provided, when relevant:

- Instructions and limits for efficient use,
- Noise level, when considered by the applicable standards,
- Electromagnetic emissions, when considered by the applicable standards,
- Instructions for a proper maintenance and service of the product,
- Information on key parts of the product determining its durability (batteries, accumulators, lamps…).

A product may reduce, through its primary function, the environmental impact of a system with which it interacts or monitors, for instance: thermostat, variable speed drive, presence detector, boiler controller, etc.

In this case, the claimed environmental impact reduction may be mentioned in the paragraph relating to the use stage in the PEP. It shall be clearly calculated, justified and documented in the LCA report.

4.3.6. End of life

It is recommended to mention actions to reduce the end-of-life impact of the product on the environment, such as participation in recycling or recovery programs, provided that details of these programs are readily available to the purchaser or user and contact information is provided.

For products subject to end-of-life treatment regulations, the presence and mass of any components or sub-assemblies that have to be sent to specific treatment centres should be mentioned (e.g. Directive 2012/19/EU on Waste Electrical and Electronic Equipment).

The quality of design of the product with respect to end of life can be mentioned. In this case, it can be measured with a recyclability rate indicator. The recyclability rate represents the recycling potential of the product in terms of its design: technology and input materials. The recycling method and potential values shall be compatible with the relevant standards. It is recommended that document CEN/CENELEC 45555 be used for electrical and electronic equipment. Other methods shall be mentioned and documented in the PSRs and the PEP and justified in the LCA report.

4.3.7. Benefits and loads beyond the system boundaries

Actions to reduce the environmental impact of the net benefits and loads beyond the life cycle stage can be mentioned.

4.4. Environmental impacts

The PEP shall include:

- The life cycle stages taken into account in the environmental impact analysis,
- The table of the functional unit environmental impacts in numerical values, expressed in the corresponding units with three significant figures (and in option as a percentage) for each stage of the life cycle, and the total for each indicator of the complete life cycle assessment, The total column of the result of the impacts calculated in the LCA shall not include the results of the net benefits and loads beyond the system boundaries stage. The results of module D may nevertheless be mentioned in the PEP, so might the split of the module B (B1 to B7). The name and version of the LCA software and database,
- The product category and the use scenario specifying:
    - The reference service life,
    - The description of the product use scenario, in order to cover the specificities of modules B1 to B7, if described,
    - The product maintenance scenario and the consumables used during the reference service life of the product category,
- Where appropriate, the applicable product standards,
- For the installation stage, the installation elements taken into account,
- Information on the geographical, time and technological representativeness of the PEP,
- The energy datasets used to determine the impacts of the manufacturing, installation, use and end-of-life stages.

Precisions regarding the scenarios used for each life cycle stage may be described in detail in the PSRs.

NOTE1: For a given indicator, a life cycle stage can be considered to be negligible if it represents less than 0.01% of the total life cycle of the reference flow. In this case, it shall be shown as 0 in the environmental impacts table for this stage and this indicator and "represents less than 0.01% of the total life cycle of the reference flow" shall be inserted below the table.*

NOTE2: the PEP may include an initial table which describes which life cycle stages are declared, which have negligeable values and which have not been declared. This allows for the results to be displayed in a more concise table, without the need for columns full of zeros.

5. PEP update rules

The development rules are specified in the general instructions of the PEP Ecopassport® program. Specific rules can be defined in the PSR.

Appendices

Appendix A: Definition of the framework of validity for a joint declaration[25]

A.1) SCOPE

The framework of validity specifies the rules and requirements applicable to (Type III) joint declarations of equipment products. It defines:

- the methodology for carrying out joint EPDs (Environmental Product Declarations),
- the requirements relating to the communication of the environmental impacts of joint environmental declarations according to the dispersion of the results,
- the rules and requirements for inclusion in joint EPDs.

Joint EPDs are established for a set of similar equipment products, intended for the same use in the construction and marketed by several different entities responsible for placing them on the market. The entities responsible for placing them on the market may include the manufacturer, the representative, the distributor or the importer.

A.2) DEFINITIONS

Influential parameter(s): Input or output data such as the mass of raw materials, types of processes, energy, quantities of waste generated, etc., associated with a process significantly contributing to one or more reference environmental impact indicators.

Sensitive parameter(s): Data inputs or outputs such as the mass of raw materials, types of procedures, energy, quantity of waste generated, etc., in which the variation within the sample studied results in a significant variation of one or more reference environmental impact indicators.

A.3) PRINCIPLES

A joint EPD covers a set of products and/or trade references of a group of manufacturers. It is generally based on the calculation of an average of the representative data of the various manufacturers and products covered; however, other methods may be envisaged. The principles developed in this appendix aim to allow:

- the representativeness of the declared results in relation to the manufacturers, products and/or trade references covered,
- the identification of the parameters, known as "sensitive parameters “, that most influence a set of reference environmental impact indicators,

[25] This appendix is based on French EN15804+A2:2019 national complementary project issued by AFNOR on 6th April 2021 and the decree project related to product environmental declaration for building construction and environmental product declaration for building environmental performance from 30th April 2021.

- an accurate description of the products covered.

A.4) METHODOLOGICAL FRAMEWORK: RULES AND RECOMMENDATIONS FOR THE LCA

The study shall take into account the following stages:

a) objectives and scope of the study:
   - determination of the manufacturers and products covered,
   - definition of the typical product and its associated functional unit or declared unit,
b) choice of method for collection of the data,
c) choice of reference environmental impact indicators to be covered by the severity and sensitivity analyses and calculation of the variability,
d) severity analysis and determination of the processes and influential parameters,
e) sensitivity analysis and determination of sensitive parameters,
f) optional: determination of the laws of distribution of sensitive parameters,
g) declared values of environmental impact indicators,
h) drawing up of the joint EPD, framework of validity and project report (or LCA report).

NOTE: An iterative approach is recommended when developing the collective EPD. Indeed, the severity analysis, then the sensitivity analysis may successively specify the stages preceding them and lead, for example, to redefining or adjusting the objective and scope of the study, definition of the typical product, representativeness of the EPD (products/trade references and manufacturers covered), sampling, and modelling of the life cycle assessment, etc.

4.1 Definition of the objectives and scope of the study

4.1.1 Preliminary analysis of the manufacturers and products covered by the joint EPD

It is recommended to identify the main differences found within the family of products to be covered and/or between manufacturers as early as possible in the study process, taking into consideration the following elements, in order of relevance:

- the manufacturing processes,
- the materials/components of the functional unit or declared unit and their procurement,
- the energy sources used during manufacture,
- the means of transport used, and the distance travelled for the distribution of the product,
- the implementation, operation and end-of-life scenarios,
- the market shares (in unit of product),
- the size of the companies,
- etc.

NOTE: pre-existing studies of the industrial sector concerned constitute a relevant information and knowledge base that may help when drawing up the joint EPD. Pre-existing studies may, for example, be sector-based or specific LCA project reports, studies on the manufacturing processes used, reporting of environmental management and production systems, Trade Practices concerning the implementation and maintenance of the product, etc.

4.1.2 Determination and description of the typical product

In order to be representative, the joint EPD concerns a product, whose physical and technical characteristics enable the performances of the functional unit or declared unit defined in the EPD concerned to be met.

The notion of "typical product" of a joint EPD makes it possible to deliver the environmental information of different products, but whose similar characteristics and components correspond to a common and specific use.

The typical product shall be correctly defined and described in order to make it easier to compare the description of a product with that of the typical product.

The description of the typical product shall contain at least:

- A list of the main constituent parts or predominant materials by mass,
- Information on the functionality and level of performance (see 4.1.3).

This identification shall make it possible to know quickly and unequivocally whether a particular product may be covered by the joint EPD subject to compliance with the conditions defined in the associated framework of validity.

The typical product may be:

- a representative product, extracted from a range common to various manufacturers and developed on one or more sites of each of these manufacturers,
- an average product weighted and obtained using specific data of each product and each site covered by the joint declaration or a sample,
- assimilated to an existing product whose environmental impact indicators are similar to those calculated within the framework of validity according to the maximizing or averaging approaches proposed (see 4.7.1).

4.1.3 Functional unit/declared unit of the typical product

The functional unit or declared unit of the typical product shall be representative of the products covered by the joint EPD. The following elements can be taken into account for its definition:

- Same main functions, including:
    - Main performance characteristics that are similar or determined according to a conservative approach,
    - In the case of cradle to grave or cradle to gate EPD with options:
        - Identical reference service life (RSL),
        - Similar life cycle scenarios considered,
        - Similar scope/functional use/intended use of the structure.
    - Similar secondary performance typology.

NOTE 1: The main and secondary performances may be expressed in the form of limited range of variation. They shall be determined in line with the intended application of the product in the structure and the required performance for the functional equivalent of the building.

NOTE 2: Conservative approaches may be implemented for the definition of the performances.

4.2 Data collection

In the case of performance of a joint EPD, certain industrial sectors have a significant number of products (various formulations) or trade references and/or production sites. A sampling method is a procedure that involves selecting, within the defined scope of the study, a set of cases considered representative and corresponding to the typical product in order to collect representative data.

The aim of sampling is to limit the study costs, improve the times for completing joint EPD, focus data collection efforts on the sensitive parameters that influence the result of the environmental impact indicators in order to obtain reliable and accurate data for these parameters.

4.2.1 Sampling representativeness

In order to be as representative as possible, the sampling shall integrate the diversity of the elements defined in paragraph 4.1.1 considering the market shares shall be used in priority as a quantitative attributes of sampling representativeness. However, when market shares cannot be used, number of sites or references could be used.

4.2.2 Data collection method

Data should be collected according to one of the following two methods:

a) Comprehensive data collection: collection is carried out as soon as the project starts on the broadest possible sample or on the set of products or production sites.

NOTE: a broad sample shall:

- *represent the largest market share possible in relation to the products covered (in the production unit) in the joint EPD,*
- *or be statistically valid/relevant.*

b) Targeted data collection: data collection is carried out in two stages:
    a. At the start of the project (before the severity then sensitivity analyses): sending of detailed questionnaires (integrating all the input/output parameters to be collected) on a restricted sample selected according to the defined scope of study,

NOTE: a restricted sample shall illustrate as best as possible the diversity of the elements found for the defined scope of study. These elements are defined in paragraph 4.1.1.

    b. After the severity (see 4.4) and sensitivity (see 4.5) analyses have been carried out, targeted questionnaires are sent in order to collect only the sensitive parameters identified on a broad sample.

4.2.3 Examples of sample selection for the data collection

The following elements are examples that do not cover all the possibilities mentioned in 4.1.1 The sampling procedure shall be defined on a case-by-case basis according to the diversity of the products and manufacturers found in the joint EPD.

Generic case of a product where the impact mainly comes from raw materials:

For a given product family, a preliminary evaluation highlights that the raw materials contribute the most to the environmental impact indicators. The sample for data collection is selected making sure in particular to integrate in the analysis:

- the diversity of the constituent materials of the main product,

- the variability of the quantities of materials of the main product (and therefore the variability of the mass per functional or declared unit as concentration variability),
- the variability of the natures and quantities of packaging,
- the diversity of the natures and quantities of installation accessories,
- the procurement of inputs (distance, transport mode),
- other.

Generic case of a product where the impact mainly comes from production processes:

For another product family, a preliminary evaluation highlights that the plant production processes are those that contribute the most to the environmental impact indicators. In this case, the sampling is selected by integrating – among other things – in the analysis:

- the energy and water consumption on production site, including if necessary, the diversity of the available profiles (e.g. various electricity mixes from one country to another),
- the emissions (air and water) generated by the production processes,
- the levels of scrap and waste generated,
- special attention may be given to the allocation rules used by the various manufacturers during the in-plant collection of data (presence of co-products, allocations made on production lines, etc.),
- other.

4.3 Choice of reference environmental impact indicators

Reference environmental impact indicators are the indicators selected concerning the severity (see 4.4) then sensitivity (see 4.5) analyses.

They are also used under the conditions defined for communicating the environmental impact indicator results (see 4.6).

Reference environmental impact indicators shall be chosen on a case-by-case basis. This choice shall be justified according to the relevance for the product category covered in the joint EPD.

As a minimum, the five following indicators shall be studied:

- total global warming,
- abiotic resource depletion – mineral,
- eutrophication,
- use of total non-renewable primary energy,
- non-hazardous waste disposed of.

4.4 Severity analysis and determination of the influential processes

4.4.1 Aim

The aim of the severity analysis is to determine the influential processes that contribute the most to the environmental impact indicator results. The list of these processes shall then be analysed in detail in order to identify which ones are the underlying parameters used for the sensitivity analysis.

4.4.2 Method for determining the influential processes

There are several ways to determine the influential processes based on the results of the environmental impact indicator calculation.

The most comprehensive approach involves working on unrelated individual basic processes, if permitted by the structuring of the collected data and the LCA model.

For example, influential processes may be identified:

- from the list of contributing processes according to a threshold of relevance, commonly of 5%, with one of the reference environmental impact indicators,
- from the list of the most influential processes that contribute to a significant threshold, commonly of 80%, of the impacts accumulated by one of the reference environmental impact indicators.

NOTE: Annex (informative) B of NF EN ISO 14044 also provides life cycle examples and interpretation principles that may help to identify the influential processes then sensitive parameters.

4.5 Sensitivity analysis and determining influential and sensitive parameters

4.5.1 Goal

The sensitivity analysis aims to determine the input and output parameters that affect the influential processes determined during the severity analysis. These parameters are named influential parameters. They are typically data such as the mass of raw materials, types of processes, energy consumed, quantities of waste generated, etc.

Each of these parameters is more or less variable according to the values taken within the sample studied. A "sensitive parameter" is a parameter whose variation results in a significant variation of the value of one or more reference environmental impact indicators.

The influential and sensitive parameters determined are used in particular to refine the collection of information in order to establish the average for the sample that is as close as possible to the typical product or the value of the sample generating the maximum impact.

4.5.2 Method for determining influential parameters

Influential parameters are determined from the list of main contributing processes established beforehand during the severity analysis. It includes all variable parameters with influence on at least one influent process on the reference environmental impact indicators.

EXAMPLE 1

In a case where the severity analysis highlights that the transport stage causes 35% of the impact of the global warming indicator, it is possible to identify several influential parameters:

- the mass and/or volume of the product transported and its packaging,
- the transport distance for each transport mode (distance by lorry, distance by boat, etc.),
- the type of fuel used,
- other.

It is possible to give preference to more upstream influential parameters such as the product mass/transport distance pair, without necessarily going into the details of the upstream data. It is possible that one of the influential parameters does not vary (if it is the same for the set of cases of

the sample). In this case, it does not need to be included in the sensitivity study: it is not a sensitive parameter.

EXAMPLE 2

If a natural gas oven baking stage in the plant causes 25% of the impact of the "Use of non-renewable primary energy" indicator, excluding non-renewable primary energy resources used as raw materials, the following influential parameters can be identified (not complete):

- the gas consumption per functional unit,
- the product mass,
- the amount of loss after baking,
- the efficiency of the equipment (related to technology, age of the installation, etc.),
- the gas mix used (related to the country where the product is manufactured),
- the processes related to the provision of gas,
- other.

As a preliminary approximation, the gas consumption by functional unit makes it possible to take into account many other parameters (efficiency, product mass, scrap level after baking, emissions in the air, etc.), and it may be considered an influential parameter.

If the declaration covers products manufactured in several countries, studying the influence of the gas mix on the result may also be necessary. If this influence is significant, the manufacturing country may also be considered as an influential parameter.

4.5.3 Method for determining sensitive parameters

Sensitive parameters are determined based on the results of the environmental impact indicator calculation. For this, the range of variation of each of the parameters taken into account needs to be determined, based on the data collected.

The parameters taken into account may be:

- the influential parameters identified during the severity analysis,
- the set of parameters after a comprehensive collection of data.

The variation ranges may be determined based on:

- a collection of data concerning a restricted sample,
- a comprehensive collection of data.

NOTE: a given parameter may be considered as sensitive (its variation results in a significant variation of one or more reference environmental impact indicators) without being one of the influential parameters identified during a severity analysis. This is typically the case when:

- *A parameter has an average or median value that leads to low environmental impacts, but whose extreme values lead to high environmental impacts,*
- *The dispersion of a parameter is not taken into account in a representative way during the sampling.*

Sensitivity analysis led to 3 groups of parameters presented below.

Group of sensitive parameters	Influence of the parameter after the sensitivity analysis	Examples associated with data quality
1	Parameters that may vary the impact of one of the reference environmental impact indicators by more than 5%	Sensitive parameter. Use a specific statistical distribution [a] based on recent measurements that are representative of the entity concerned.
2	Parameters that may vary the impact of one of the reference environmental impact indicators by more than 1%	Sensitive parameter. As a minimum, use a simple statistical distribution [b] based on relatively recent measurements that are representative of the entity concerned
3	Other parameters	Non-sensitive parameter. Use the most probable or average value for the entity concerned
a Specific statistical distribution: normal distribution, discrete distribution, other b Simple statistical distribution: interval with equiprobability or mini-maxi		

Table 5: Example of sensitive parameter classification criteria

EXAMPLE sensitive parameters identification

A severity analysis made it possible to determine two influential parameters on the global warming impact indicator:

- the quantity of gas consumed during production,
- the transport distance between the plant and the point of sale.

A preliminary collection of data makes it possible to estimate the possible values for each of these parameters (their range of variation). A calculation over the entire life cycle based on the available information highlights that:

- the variation of the transport distance results in a variation in the global warming impact indicator of 20%,
- the variation of the quantity of gas consumed during production results in a variation in the global warming impact indicator of 2%.

A variation threshold of 5% with one of the reference environmental impact indicators is defined to identify the sensitive parameters. After the calculations, the transport distance is therefore considered as a sensitive parameter.

4.5.4 Data collection on sensitive parameters

For these sensitive parameters, it is recommended, on the one hand, to improve the quality of the investigations for the collection of specific data and, on the other hand, for the assessment of the generic data that are associated with them in the LCA modelling. See requirements on sampling representativeness in 4.2.1 and requirements on variation ranges identification in 4.6.3.1.

As a reminder, all sensitive parameters shall be considered for the purpose of collecting quality data. This is decisive when the "two-stage" collection method is chosen (see 4.2). Determination of the sensitive parameters once completed leads to the second stage of data collection: targeted collection but on a broad sample.

4.6 Environmental indicators variability assessment

4.6.1 Goal

Based on sensitivity analysis and broad data collection, this step aims at using mathematical approach to identify variation ranges of environmental indicators (maximum values, average values and minimum values) based on sensitive parameters sensitivity on LCA model.

Results of such variability assessment is a set of ranges and/or distribution laws for each reference environmental indicator.

Variability assessment could be iterative to adapt the sensitive parameters variation ranges to the scope defined by the joint EPD responsible. This adaptation means:

- Narrowing down the validity domain to discard some values linked to extraordinary practices while keeping a single EPD (for instance: gigantic doors, façade coating for extremely harsh environmental conditions…),
- Splitting the parameter variation range to undertake an EPD for each split part.

Parameter variation range unknown from EPD users cannot be adapted (for instance: manufacturing sites energy consumption, confidential bills of materials…).

Narrowing down variation range with consequence to discard more than 20% of products identified in the EPD title shall lead to title update.

Splitting the variation domain shall lead to a dedicated EPD with an explicit and individual name for each split part allowing to clearly identify those.

In any case, for a given parameters a conservative value could be used (for instance maximum or minimum value, etc.) and then do not include it in the variability assessment (since declared environmental indicators value would be conservative as well).

4.6.2 Scope

Environmental indicators variability assessment is based on sensitive parameters such as:

- Bills of materials,
- Packaging weights,
- Manufacturing processes,
- Energy consumption or any other relevant parameters whose use phase contribution is significant.

For joint EPD undertaken after 1st of October 2021, variability assessment also encompasses sensitive parameters on transportation to construction site if relevant for the studied product (justification needed in LCA report). If no sensitive parameter was identified in the scope mentioned above, variability assessment is performed on sensitive parameters from other life cycle steps.

NOTE: it is recommended anyhow to extend variability assessment on all sensitive parameters on the whole life cycle.

4.6.3 Assessment method

Following steps are recommended when a variability assessment is performed:

a) Sensitive parameters variability ranges identification from severity, sensitivity analysis and broad data collection,
b) Product life cycle modelling,
c) Parametrised simulation based on sensitive parameters variation.

4.6.3.1 Sensitive parameters variability ranges identification

This step consists in identifying variation range for each identified sensitive parameter through severity and sensitivity analysis, included in the variability assessment scope. The variation range for each sensitive parameter is identified based on data collection from sampling defined in 4.2.

Statistical approach to defined averages, standard deviations, bounds, etc. for each sensitive parameter is recommended. At least, such domain shall be presented with a range form. If it is known, a distribution law of a given parameter in its range could be provided. Sensitive parameters variation range is an element of the validity framework.

4.7 Values of the environmental impact indicators declared in the joint EPD

If a conservative approach is chosen, the values of the environmental impact indicators to be declared shall be calculated based on the most detrimental values of the sensitive parameters or on the actual configuration (typical product assimilated to an existing product, see 4.1.2) maximizing the impacts. When the maximum value of each reference environmental indicator is inferior or equal to 1.4 the indicator "average" value, then the declared environmental indicators shall be calculated with reference environmental indicators "average" values; see example 1 below.

If not, i.e. at least one reference environmental indicator has a maximum value strictly superior to 1.4 the indicator "average" value, then the upper bound shall be declared. This upper bound represents the environmental indicator value obtained when sensitive parameters maximum value (or maximum with a 95% probability if a statistical approach is used) are used; see example 2 below.

For joint EPD undertaken after 1st of October 2022, the threshold previously mentioned would drop to 1.3 the indicator "average" value.

This concerns only the "maximum" value, no requirement occurs on "minimum" value.

EXAMPLE 1

- Global warming: variation range [3; 7], average 6, 7/6 <1.4,
- Use of non-renewable primary energy, excluding non-renewable primary energy resources used as raw materials: variation range [150; 200], average 190, 200/190 < 1.4,
- Non-hazardous waste disposed of: variation range [3; 6], average 5, 6/5<1.4,
- The values of the declared environmental impact indicators shall be calculated based on the average values of the sensitive parameters.

EXAMPLE 2

- Global warming: variation range [3; 7], average 4, 7/4>1.4,

- Use of non-renewable primary energy, excluding non-renewable primary energy resources used as raw materials: variation range [150; 200], average 190, 200/190 < 1.4,
- Non-hazardous waste disposed of: variation range [150; 200], average 190, 200/190<1.4,
- The values of the declared environmental impact indicators shall be calculated based on the upper bound values of the sensitive parameters.

When an inventory is communicated to an auditor, it shall be consistent with the environmental impact indicator calculation results.

A.5) PROJECT REPORT (OR LCA REPORT)

Concerning the framework of validity of joint EPDs, the project report shall clearly document and systematically justify the methodologies and/or data used and/or the results obtained for:

- the determination and description of the typical product and its functional unit or declared unit,
- the products and manufacturers covered (they may be described by their membership to a collective entity or organization),
- the development of scenarios for the typical product,
- the sampling method retain if appropriate: the definition of the sample and its representativeness,
- the choice of reference environmental impact indicators,
- the severity analysis and identification of influential processes,
- the sensitivity analysis and determination of sensitive parameters,
- environmental indicators variability assessment,
- the scope of validity of the joint EPD and the variation ranges of the environmental impact indicators.

NOTE: The method for determining the scopes of variability of sensitive parameters such as the method for calculating non-sensitive parameters shall be included in the project report.

A.6) CONTENT OF THE FRAMEWORK OF VALIDITY

The framework of validity shall contain at least:

- the description or identification of the typical product,
- the products covered in the joint EPD,
- the identification of declarants who may use the joint EPD in nominative and complete list form.
- The sensitivity analysis report including the validity domain with justification that the declared indicator values ae homogeneous.

As the joint EPD is collectively-owned, this collective entity may decide that only certain marketing entities may use this joint EPD. As such within the PEP Ecopassport® program, the joint PEP shall mention the nominative and exhaustive list of marketing entities entitled to use a joint EPD.

A.7) USE OF THE FRAMEWORK OF VALIDITY

A marketing entity wishing to refer to a joint EPD shall declare the information allowing it to demonstrate compliance with the framework of validity. Therefore, it must justify:

- that the product complies with the "typical product" covered by the joint EPD,
- that it is, in the list of authorized marketing entities for this joint EPD,
- that it complies with the scope of validity of this joint EPD. This means that the sensitive parameter values for their product are within the range of variation of the sensitive parameters authorized by the joint EPD.

Appendix B: Diagram of the system boundaries for the LCA

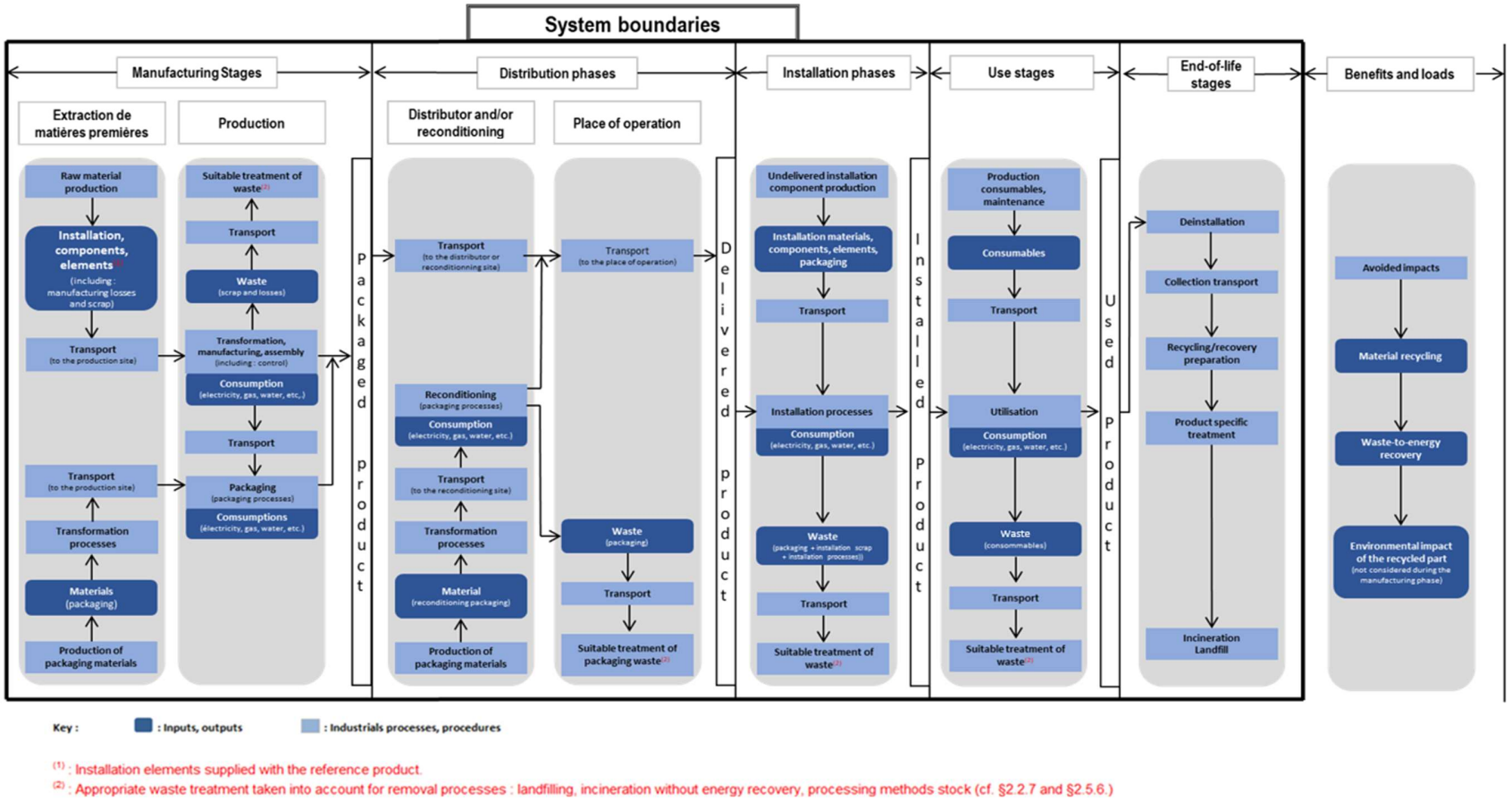


Figure 3: System boundaries according to PCR edition 4.0

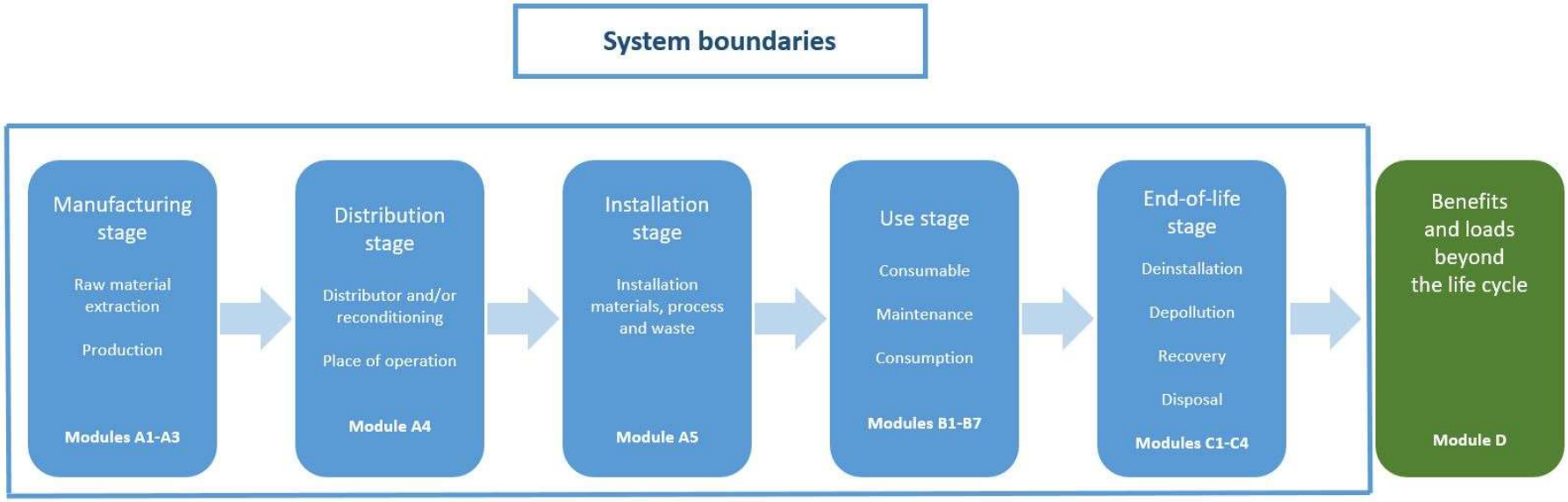


Figure 4: Sub-modules according to EN 15804:2012 +A2:2019 (according to Appendix C)

1 A1: Raw material extraction and processing
2 A2: Transport to the manufacturer
3 A3: Manufacturing
4 A4: Distribution to the place of operation
5 A5: Installation on the place of operation
6 B1: Use or application of the product installed
7 B2: Maintenance
8 B3: Repair
9 B4: Replacement
10 B5: Restoration
11 B6: Energy requirements during the use stage
12 B7: Water requirements during the use stage
13 C1: Deinstallation
14 C2: Transport to the waste treatment site
15 C3: Treatment of waste in view of its reuse, recovery and/or recycling
16 C4: Disposal
17 D: Benefits and loads beyond the system boundaries

Appendix C: Specificities for the Product Environmental Profile within the French regulatory framework[26]

This paragraph states the replacement or additional rules for calculating impact indicators and drawing up the Product Environmental Profile, if the declaring party wishes to file an individual or joint PEP within the French regulatory framework.

C.1) ENVIRONMENTAL IMPACTS ASSESSMENT

C1.1 Indicators list to mention:

The impact indicators are as follows:

- Environmental impact indicators:
  - Global warming, expressed in kg CO_2 eq,
  - Ozone depletion expressed in kg CFC-11 eq,
  - Acidification of soils and water, expressed in kg SO_2 eq,
  - Water eutrophication, expressed in kg $(PO_4)^{3-}$ eq,
  - Photochemical ozone formation, expressed in kg C_2H_4 eq,
  - Depletion of abiotic resources - elements, expressed in kg Sb eq,
  - Depletion of abiotic resources – fossil fuels, expressed in MJ.
- Inventory flows indicator:
  - Total use of primary energy during the life cycle, expressed in MJ,
  - Net use of fresh water, expressed in m^3,
  - Indicators describing the use of primary energy resources:
    - ✓ Use of renewable primary energy, excluding renewable primary energy resources used as raw materials, expressed in MJ,
    - ✓ Use of renewable primary energy resources used as raw materials, expressed in MJ,
    - ✓ Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials), expressed in MJ,
    - ✓ Use of non-renewable primary energy, excluding non-renewable primary energy resources used as raw materials, expressed in MJ,
    - ✓ Use of non-renewable primary energy resources used as raw materials, expressed in MJ,

[26] This appendix is based on the decree project related to product environmental declaration for building construction and environmental product declaration for building environmental performance from 30th April 2021.

- ✓ Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials), expressed in MJ.

- Indicators describing the use of secondary materials and energy resources (e.g. waste combustion):
  - ✓ Use of secondary materials, expressed in kg,
  - ✓ Use of renewable secondary fuels, expressed in MJ,
  - ✓ Use of non-renewable secondary fuels, expressed in MJ.
- Indicators describing categories of waste:
  - ✓ Hazardous waste disposed of, expressed in kg,
  - ✓ Non-hazardous waste disposed of, expressed in kg,
  - ✓ Radioactive waste disposed of, expressed in kg.
- Indicators describing output flows:
  - ✓ Components for reuse, expressed in kg,
  - ✓ Materials for recycling, expressed in kg,
  - ✓ Materials for energy recovery, expressed in kg.

Exported energy, expressed in MJ by energy vector.

From October 1, 2022 indicator for the quantity of atmospheric carbon stored in the equipment or biogenic carbon content of the product, expressed in kg of C[27]

C.1.2. Net benefits and loads linked to end of life valorisation

The net benefits and loads calculation is aligned with the formula provided in 2.2.8 (Module D).

C.2) DRAWING UP THE PRODUCT ENVIRONMENTAL PROFILE

Whether supplementing or replacing the information specified in Chapter 4 of this document, the PEP must contain the following information:

1. INFORMATION ABOUT THE REFERENCE PRODUCT:

- The declared unit if the functional unit cannot be used directly,
  - Example:

"Ensure the production of domestic hot water or heating using a 5 kW heat pump over a reference service life of 17 years (the power should be adjusted to reflect the relevant product in the range)".

- The equipment's scope of product.

2. ENVIRONMENTAL IMPACTS:

- The impact indicator results specified in C.1 for each stage in the life cycle considered in the LCA, including:
  - From January 1, 2022, a detailed description of the use stage (Modules B1 to B7).
  - From October 1, 2022 the net benefits and loads beyond the system boundaries stage (Module D) associated with end-of-life recovery in a separate column.

[27] This indicator may be declared void for items of equipment that are covered by the program and which are not concerned.

NOTE: the composition of the sub-modules to be declared is presented in Figure 4 *of Appendix B.*

NOTE: The total column of the result of the impacts shall not include the results of the net benefits and loads beyond the system boundaries stage (Module D).

3. ADDITIONAL INFORMATION:
    - The description of the reference product must include the quantity of principle product, packaging weight, and if relevant, the quantity for any additional equipment required for implementing the product in question or managing its end of life.

C.3) LCA REPORT

Complementary to information mentioned in Chapter 3, the PEP LCA report shall contain the following information so they could be delivered to PEP ecopassport® program or any administrative authority, or their representative, in charge of auditing and control:

- Raw materials, materials and product components origins,
- Identification of non-included inputs in life cycle inventory according the cut off rules,
- Total weights of non-included inputs in life cycle inventory according to cut-off rules,
- Life cycle inventory calculations results,
- Justification of product reference service life,
- For secondary data based on public or private database: documentation on technology, geography and time representativeness, database references and datasets references,
- Life cycle inventory scenarios,
- Manufacturing sites covered by the EPD,
- For each site: unitary production defined within the functional unit,
- If a sampling method was used: justification of sample technology, geography and time representativeness,
- Validity framework information for the declaration of a joint EPD (see appendix A),
- Information of parametrized declaration (see Chapter 2.6).

Appendix D: Example of calculation of Module D

An example of calculation is available below, if the formula with net benefits of EN 50693 and the available LCI datasets are considered:

Stage	Formulas		Equivalence with the LCI datasets		E.g. in the case of a 1 kg part with 30% recycled PP
Production	Impacts relating to input primary materials	$\sum_{i=1}^{n}(1-R_{1(i)})\times M_i \times E_{PM(i)}$			70% x 1 kg x Module [Virgin material manufacturing impacts]
	Impacts relating to input secondary materials	$\sum_{i=1}^{n} R_{1i}\times M_i \times E_{MR\ after\ PS\ i}$			30% x 1 kg x Module [Impacts of all stages carried out for the recycled material <u>after</u> the point of substitution (mainly the transport between the "regenerator" of the recycled material and the product manufacturing plant in our case)]
End of life	Impacts relating to end-of-life material recovery operations	$\sum_{i=1}^{n} R_{2i}\times M_i \times E_{MR\ including\ PS\ i}$	WEEE EOL LCI scope without benefit = Modules C2, C3 and C4	WEEE EOL LCI scope with benefits $+R_{1i}\times M_i \times E_{PM\ i}$ (i.e. the substitution benefits associated with integration of the recycled R1 is subtracted from these LCI in the production stage) = Modules C2, C3, C4 + Module D	1 kg x Module [PP End of life LCI without benefit]
	Impacts relating to end-of-life energy recovery operations	$\sum_{i=1}^{n} R_{3i}\times M_i \times E_{ER\ including\ PS\ i}$			
	Impacts relating to end-of-life disposal operations	$\sum_{i=1}^{n}(1-R_{2i}-R_{3i})\times M_i \times E_{Di}$			
	Net impacts prevented relating to end-of-life output energy/materials	$\sum_{i=1}^{n}(-R_{2i}\times M_i \times E^{*}_{PM\ i} - R_{3i}\times M_i \times -E_{SE\ i} + R_{1i}\times M_i \times E_{PM\ i})$			1 kg x – (Module [PP End of life LCI with benefits] – Module [PP End of life LCI without benefit]) + 30% x 1 kg x Module [Virgin material manufacturing impacts]

Table 6: Baded Table G-4 of the EN 50693 standard, the following default values for R1, R2 and R3 could be applied in case of the lack of specific data

Parameter in EoL Formula		Material recycled content (R1)	Material recovery rate (R2)	Energy recovery rate (R3)	Disposal rate (1 – R2 – R3), by landfilling or incineration without energy recovery
Metals	Steel	0 %	80 %	0 %	20 %
	Other ferrous metals	0 %	80 %	0 %	20 %
	Aluminium	0 %	70 %	0 %	30 %
	Copper	0 %	60 %	0 %	40 %
	Other non-ferrous metals	0 %	60 %	0 %	40 %
Plastics	PP	0 %	20 %	40 %	40 %
	PS-HiPS	0 %	20 %	40 %	40 %
	ABS	0 %	20 %	40 %	40 %
	PU foam	0 %	0 %	50 %	50 %
	Rubber	0 %	0 %	50 %	50 %
	Other plastics or plastics containing additives/fillers (e.g.: glass fibres, BFR, …)	0 %	0 %	50 %	50 %
Minerals	Glass	0 %	60 %	0 %	40 %
	Concrete	0 %	0 %	0 %	100 %
	Other minerals (e.g.: glass wool)	0 %	0 %	0 %	100 %
PCBs	PCBs (support)	0 %	0 %	0 %	100 %
	PCBs (metals)	0 %	50 %	0 %	50 %
Others	Oil	0 %	70 %	0 %	30 %
	Wood	0 %	0 %	50 %	50 %
	Bitumen	0 %	0 %	30 %	70 %

Table 7: Parameter in EoL Formula

Appendix E: Data Quality Rating (DQR)

DQR tables for processes for which secondary datasets are used from Chapter 7.19.2.2 of the Product Environmental Footprint Guide, version 6.3 (EF= Environmental Footprint).

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

Appendix F: Gap Analysis with ISO 14067:2018 Caron Footprint Product

For a PEP to align with the ISO 14067:2018 the following steps (non exhaustive list) shall be fulfilled:

1. The report must be called "CFP study report",
2. Latest IPCC calculation method should be used for GWP/Climate change indicators, if not it must be stated & justified,
3. Aircraft transportation GHG emissions (when applicable) shall be included in the CFP and documented separately in the CFP study report,
4. The following items which are to be mentioned in the confidential LCA report accompanying the PEP must be mentioned in the CFP study report:
    a. data and data quality requirement,
    b. limitations of the CFP study,
    c. list of important unit processes,
    d. data collection information, including data sources,
    e. either provide list of GHGs taken into account and the selected characterization factors or provide an internet link to website in which they can be found.
5. The life cycle interpretation phase of a CFP study shall comprise the following steps:
    a. identification of the significant issues based on the results of the quantification of the CFP and partial CFP in accordance with LCI and LCIA phases,

    NOTE: Significant issues can be life cycle stages, unit processes or flows.

    b. an evaluation that considers completeness, consistency and sensitivity analysis,
    c. the formulation of conclusions, limitations and recommendations.

The results of the quantification of the CFP and partial CFP according to the LCI or LCIA phases shall be interpreted according to the goal and scope of the CFP study. The interpretation shall:

- include an assessment of uncertainty, including the application of rounding rules or ranges,
- identify and document the selected allocation procedures in the CFP study report in detail,
- identify the limitations of the CFP study (in accordance with, but not limited to, Annex A).

The interpretation should include:

- a sensitivity analysis of the significant inputs, outputs and methodological choices, including allocation procedures, in order to understand the sensitivity and uncertainty of the results,
- an assessment of the influence of alternative use profiles on the final result,
- an assessment of the influence of different end-of-life scenarios on the final result,

- an assessment of the consequences of recommendations [see 6.6 c) of ISO 14 067:2018] on the final result.

6. Verification: The CFP study report must be certified by CFP certifier.

NOTE 1: A PEP always accounts for the whole life cycle of the product. Thus, a PEP always represents a full CFP and can never represent a partial CFP.

NOTE 2: PEP calculates "Land use & Land use change (direct & indirect)", this indicator will overestimate impacts of what is expected from the CFP indicator "Direct land use change".

NOTE 3: More detailed guidance on how to consider emissions related to electricity production, additional guidance on how to account for internally generated electricity from a directly connected supplier, specific paragraph on how to consider grid electricity with green bond is given in 6.4.9.4 of the ISO 14067:2018. No additional action is required if conventional electricity from grid is considered in the study.

Appendix G: Terms and definitions

The terms and definitions are given for information only. They can be used in full or in part in the environmental declaration or supplemented by additional information. Their purpose is to educate the customer and also to ensure that each term used has a corresponding definition which is either officially recognized or clearly defined.

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 14040:2006].

Environmental Product Declaration: Environmental declaration providing quantified data based on environmental indicators and, when relevant, additional environmental information.

NOTE 1: environmental indicators assessment is based on ISO 14040-44 series.

[14025:2006]

Product Environmental Profile (PEP): An Environmental Product Declaration based on Product Category Rules of the PEP Ecopassport Association.

NOTE 1: Historically this definition is specifics for Electrical, Electronic and Heating Ventilation Air Conditioning-Refrigeration (HVAC-R) products covered by the program Ecopassport.

Environmental aspect: element of an organization's activities or products or services that can interact with the environment.

[ISO 14050:2010]

Impact category: class representing environmental issues of concern to which life cycle inventory analysis results may be assigned.

[ISO 14040:2006]

Secondary fuel: fuel recovered after a first use or retrieved from waste, that replaces primary fuels.

[EN 15804:2012+A1:2013]

Co-product: any of two or more products coming from the same unit process or product system.

NOTE: Two pieces of sheet metal from a single coil, but intended for two distinct products, are an example of co-products.

[ISO 14044:2006]

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]

Data quality rating (DQR): data quality indicator, calculated according to the formula in PEF Guidance, version 6.3

Hazardous waste: specific waste with a certain degree of toxicity that necessitates special treatment (as indicated in Directive 91/689/EC and decision 2532 EC).

Non-hazardous waste: non-toxic waste similar to household waste.

Joint environmental declaration: environmental declaration on a "typical product" included in the same category product representing similar products marketed by different entities.

Primary data: input or output measured on a site or a real specific process.

Secondary data: input or output data not from direct measurement, but either from published sources, statistics or data sources (e.g. commercial databases and free databases) used to substitute primary data.

Reference service life (RSL): lifetime that may be expected according to a particular set (reference set) of conditions of use and that may be used to estimate the lifetime under other conditions of use.

[EN 50693:2019, 3.35]

NOTE: The reference service life is also referred to as "typical". This is a theoretical period used for calculation purposes. It can never be compared to the minimum, average or actual lifetimes of the products.

The reference service life shall be based on standards, default value could be used with justification. EN 45552:2020 – General method for the assessment of the durability of energy-related products – Could be used, so is the EN 15686 series to assess Durability for products installed in Building. More details on specific reference service life are available in PSR.

Eco-solution: products or services allowing a reduction in the environmental impacts of an installation.

Proportional to the reference flow: impact which changes according to the quantities produced.

Reconditioning packaging: additional or replacement packaging for a product provided during the distribution stage.

Output: product, material or energy flow that leaves a unit process.

[ISO 14040:2006]

Homogeneous environmental family: group of products shall have the following characteristics: Same main functionality; same product standards; and, similar manufacturing technology: same type of materials and manufacturing processes.

Reference flow: measure of the outputs from processes in a given product system required to fulfill the function expressed by the functional unit.

[ISO 14044:2006]

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

[ISO 14040:2006]

Intermediate flow: product, material or energy flow occurring between unit processes of the product system being studied.

[ISO 14040:2006]

System boundary: set of criteria specifying which unit processes are part of a product system.

[ISO 14040:2006]

Specific LCI: LCI conducted for a material, component, subassembly or product based on primary data.

Environmental impact: any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services.

[ISO 14050:2010]

Impact category indicator: quantifiable representation of an impact category.

[ISO 14040:2006]

Input: product, material or energy flow that enters a unit process.

[ISO 14040:2006]

Life cycle inventory analysis (LCI): phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a given product system throughout its life cycle.

[ISO 14040:2006]

Raw material: primary or secondary material that is used to produce a product.

NOTE: Secondary material includes recycled material

[ISO 14040:2006]

Life cycle inventory dataset: set of life cycle inventory data on a material, a component or a generic process, available in a database to conduct life cycle assessments at a higher level of integration.

Unit process: smallest element considered in the life cycle inventory analysis for which input and output data are quantified.

[ISO 14044:2006]

Reference product: product or product system, supplied by the manufacturer, modeled in the LCA and allowing the defined functional unit to be matched.

Product-Specific Rules (PSR): set of additional specific rules, requirements and guidelines for developing Type III environmental declarations for a product category.

Recyclability: ability of component parts, materials or both that can be diverted from an end-of-life stream to be recycled.

[ISO 22628:2002]

Recycling: reprocessing in a production process of the waste materials for the original purpose or for other purposes, excluding processing as a means of generating energy.

[ISO 22628:2002]

Product Category Rules (PCR): set of specific rules, requirements and guidelines for developing Type III environmental declarations for one or more product categories.

[ISO 14025:2006]

Reusability: ability of component parts that can be diverted from an end-of-life stream to be reused.

[ISO 22628:2002]

Product system: collection of unit processes with elementary and product flows, performing one or more defined functions, and which models the life cycle of a product.

[ISO 14040:2006]

Recyclability rate: percentage of the mass of an item of equipment that may potentially be recycled or reused.

[ISO 22628:2002]

Functional unit: quantified performance of a product system for use as a reference unit in a life cycle assessment.

[ISO 14040:2006]

Declared unit: The quantity of product used as a reference for the environmental declaration (could be expressed in in weight, length, surface area, volume etc…). The declared unit might differ from the functional unit in terms of the declaration.

Appendix H: Bibliography

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 14027: 2017 "Environmental labels and declarations – development of product category rules".

ISO 14067: 2018 "Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification".

IEC/TR 62635: 2012 "Guidelines for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment".

IEC 62474: 2012 March 2012 "Material Declaration for Products of and for the Electrotechnical Industry".

ELCD: European Reference Life Cycle Database, Joint Research Center.

EN 15804: 2012+A1:2013 + CN/2016: Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

EN 15804: 2012+A2:2019: Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

ISO 50693:2019: Product category rules for life cycle assessments of electronic and electrical products and systems.

Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products (ERP).

Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE).

Product Environmental Footprint (PEF) Guide of the European Commission, March 2019 version 6.3.

Product Environmental Footprint Category Rules (PEFCR) Uninterruptible Power Supply (UPS), version 5.2, February 2019.

AP0012: document PEP–AP0012–ed. 2-EN- "LCA report content" available from the PEP ecopassport® program.

AP0008: document PEP-AP0008-ed 2-EN- "Editorial rules" available from the PEP Ecopassport® program.

The **French decree project** related to product environmental declaration for building construction and environmental product declaration for building environmental performance from 30th April 2021.

Appendix I: Recommended impact categories and indicators according to EN 50693

Impact category	Indicator	Unit	Recommended default LCIA method	Classification
Climate change	Radiative forcing as global warming potential (GWP100)	kg CO_2 eq.	Baseline model of 100 years of the IPCC (based on IPCC 2013)	I
Ozone depletion	Ozone depletion potential	kg CFC-11 eq.	Steady-state ODPs from the WMO assessment (1999)	I
Human toxicity, cancer effects*	Comparative toxic unit for humans (CTUh)	CTUh	USEtox model (Rosenbaum et al., 2008)	III/interim
Human toxicity, non-cancer effects*	Comparative toxic unit for humans (CTUh)	CTUh	USEtox model (Rosenbaum et al., 2008)	III/interim
Particulate matter/respiratory organics	Impact on human health	Incidence of diseases in Deaths/kgPM2.5 emitted	Model recommended by UNEP (Fantke et al. 2016)	I
Ionizing radiation, effects on human health	Human exposure efficiency relative to U235	kBq U235	Human health effect model as developed by Dreicer et al., 1995 (Frischknecht et al., 2000)	II
Photochemical ozone formation	Tropospheric ozone concentration increase	kg NMVOC eq.	LOTOS-EUROS (Van Zelm et al., 2008) as applied in ReCiPe	II
Acidification	Accumulated exceedance	mol H_+ eq.	Accumulated exceedance (Seppälä et al. 2006, Posch et al., 2008)	II
Eutrophication, terrestrial	Accumulated exceedance	mol N eq.	Accumulated exceedance (Seppälä et al.	II

			2006, Posch et al., 2008)	
Freshwater eutrophication	Nutrients reaching the end compartment (P)	freshwater: kg P eq.	EUTREND model (Struijs et al., 2009b) as implemented in ReCiPe	II
Marine eutrophication	Nutrients reaching the end compartment (N)	seawater: kg N eq.	EUTREND model (Struijs et al., 2009b) as implemented in ReCiPe	II
Freshwater ecotoxicity*	Comparative toxic unit for ecosystems (CTUe)	CTUe	USEtox model (Rosenbaum et al., 2008)	III/interim
Land use	- Soil quality index[1]	- Adimensional	Soil quality index based on LANCA (Beck et al. 2010 and Bos et al. 2016)	III
Water resource depletion	Potential deprivation (water use related to scarcity)	m3 global saving eq.	Available WAter REmaining (AWARE) Boulay et al., 2016	III
Resource use - mineral	Abiotic resource depletion (ADP ultimate reserves)	Kg Sb-eq	CML 2002 (Guinée et al., 2002) and van Oers et al. 2002	III
Resource use - fossil	Abiotic resource depletion – fossil fuels (ADP-fossil)	MJ	CML 2002 (Guinée et al., 2002) and van Oers et al. 2002.	III

Appendix J: Critical review certificate

PEP ECOPASSPORT® PROGRAMME

Certificate of critical review of the PRODUCT CATEGORY RULES FOR ELECTRICAL, ELECTRONIC AND HVAC-R PRODUCTS

Critical reviewers:

Role	*Identification*
Panel Chairwomen	*Dipl. Eng. Julie ORGELET* *LCA independant Expert - DDemain*
Member of the panel	*Tim Osmond* *Consulting engineer in LCA and Eco-design - PEP ecopassport accredited auditor - EVEA*
Member of the panel	*Master. Pierre RAVEL* Research and Studies Engineer, at « Division Environnement et Ingénierie du Cycle de Vie » of the « Centre Scientifique et Technique du Bâtiment (CSTB) »
Member of the panel	*Dr. Eva Schmincke* *LCA independent Expert, former convenor of product section, development of EN 15804*

Document reviewed: PRODUCT CATEGORY RULES FOR ELECTRICAL, ELECTRONIC AND HVAC-R PRODUCTS

Version and date: PCR-ED4-EN-2021 09 06

Review period: May - July 2021

Prepared by : PEP association members

Review repository:

The results of the PCR review as well as comments and recommendations made by the panel are available on request from the PEP association.

A critical review was performed between May and July 2021 by a panel of 4 LCA experts, EPD practitioners and verifiers: Julie DELMAS –ORGELET, Eva SCHMINCKE, Pierre RAVEL, Tim OSMOND at the end of the elaboration process of the 4th edition of PEP ecopassport ® program PCR.

The critical review aims at insuring the compatibility with:

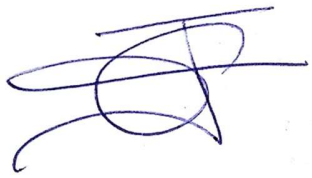
Theme	Standards	Level of constraints
Philosophy –Environmental declaration	ISO 14 025 – ISO 14 040/44	Mandatory – full compliance except on data issue
Core methodology	EN 50 693	Mandatory – full compliance
Core methodology	EN 15804+A2 :2019	Optional – partial compliance
Impact indicators	EN 15804+A2 :2019	Mandatory – full compliance
End of Life - Module D	EN15804+A2 :2019	Recommended – partial compliance/compatibility
Data Quality indicator	PEF Guidance	Optional – first steps
Annex A - Collective Declaration – Validity Framework	French regulation	Mandatory – full compliance
Annex C - Specificities for the Product Environmental Profile within the French regulatory framework	French regulation	Mandatory – full compliance

Conclusion :

At the end of the critical review process, the review panel concludes that the PCR document is compliant with the review framework presented below.

The reviewer point out the fact that all of the comments were treated with an approach that is both precise and pragmatic.

Some improvements axis are proposed in the final CR synthesis.



Julie ORGELET - DDemain

Independant LCA Expert

Le 27/07/2021