

# Product Category Rules



## PRINTED CIRCUIT BOARD ASSEMBLY

UN CPC code: 46213











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## PRODUCT CATEGORY

1. Product category definition
2. Product category description
3. Declared Unit
4. Product lifetime



## 1. Product category definition

This document provides Product Category Rules (PCR) for the assessment of the impact on climate change of Printed Circuit Boards Assembly and the declaration of this performance by a CFP. The product category corresponds to UN CPC 46 Electrical machinery and apparatus.

The product category is defined under UNSD-CPC Ver 2.1 classification:

Division 46: Electrical machinery and apparatus.

462: Electricity distribution and control apparatus, and parts thereof

4621: Electricity distribution or control apparatus

46213: Boards, consoles, cabinets and other bases, equipped with electrical switching etc. apparatus, for electric control or the distribution of electricity, for a voltage not exceeding 1000 V

The switchboards (UN CPC code 46213) are excluded from the scope of the present PCR, since these products are covered by the specific PCR "015 - Switchboards" of EPDIItaly.

Within the present PCR, the following terminology is adopted:

- The term "shall" is used to indicate what is obligatory.
- The term "should" is used to indicate a recommendation, rather than a requirement.
- The term "may" or "can" is used to indicate an option that is permissible.

For the definition of terms used in the document, see the normative standards.

## 2. Product category description

The PCBA (printed circuit board assembly) is a PCB populated with electronic components.

The PCBA can be used as electronic devices for safety and control of appliances for residential climate control and these are composed by the board itself and other set of ancillary devices.

The Electronic Controls are suitable to be used on all Domestic and Commercial Appliances, such as Central Heating, Combi Gas Boilers and Hybrid Appliances (both Standard Efficiency and Premix boilers), Room Heaters, Water Heaters, Fireplaces, Catering appliances.

The main types of controls are:

1. Automatic Burner control: electronic device specifically designed to control the safety functions of the gas Appliances. Many options can be implemented, such as:
  - versions suitable for appliances with atmospheric burner both with natural draught and fan assisted or for appliances using a premix burner
  - the spark igniter can be integral to the board

- versions with single or double probe for ignition and flame supervision MODBUS communication port for burner remote control
  - serial port for diagnostic communication
  - temperature control using sensors
  - with Intermittent Pilot Ignition or Continuous Pilot Ignition or both (selection by a switch)
  - supplied at mains supply AC to low DC voltage or by batteries
2. Full control for Gas Appliances: Electronic boards that integrates both the Automatic Burner Control and temperature controls function for gas-fired appliances. Options such as:
- The board can integrate the control of the fan and other devices inside the appliance
  - developed with digital microprocessor technology
  - It can be controlled by a remote chrono-thermostat.
  - It can be battery operated
  - Display, HMI
3. Full control of Heat Recovery Units or other appliances for the household climate control.

### 3. Declared Unit

The declared unit is a single printed circuit board assembly (PCBA).

Moreover, describing the declared unit, the following items shall be specified:

- PCB Dimensions
- Number of active components (IC and Transistors)

### 4. Product lifetime

Not relevant for the system boundaries of this PCR.



## SYSTEM BOUNDARIES

1. Diagram
2. Upstream
3. Core



Carbon Footprint Italy follows an approach that include all attributional processes from “cradle to grave”, using the “limited loss of information at the final product” principle. This is especially important in the case of business-to-consumer communication.

The scope of this PCR and of CFPs based on this document is **cradle to gate**.

For the purpose of different data quality rules and for the presentation of results, the life cycle of products is split into two different life cycle stages:

- Upstream processes (from cradle-to-gate);
- Core processes (from gate-to-gate).

In the CFP, the impact on climate change associated to each of the two life-cycle stages mentioned above shall be reported separately.

## 1. Diagram

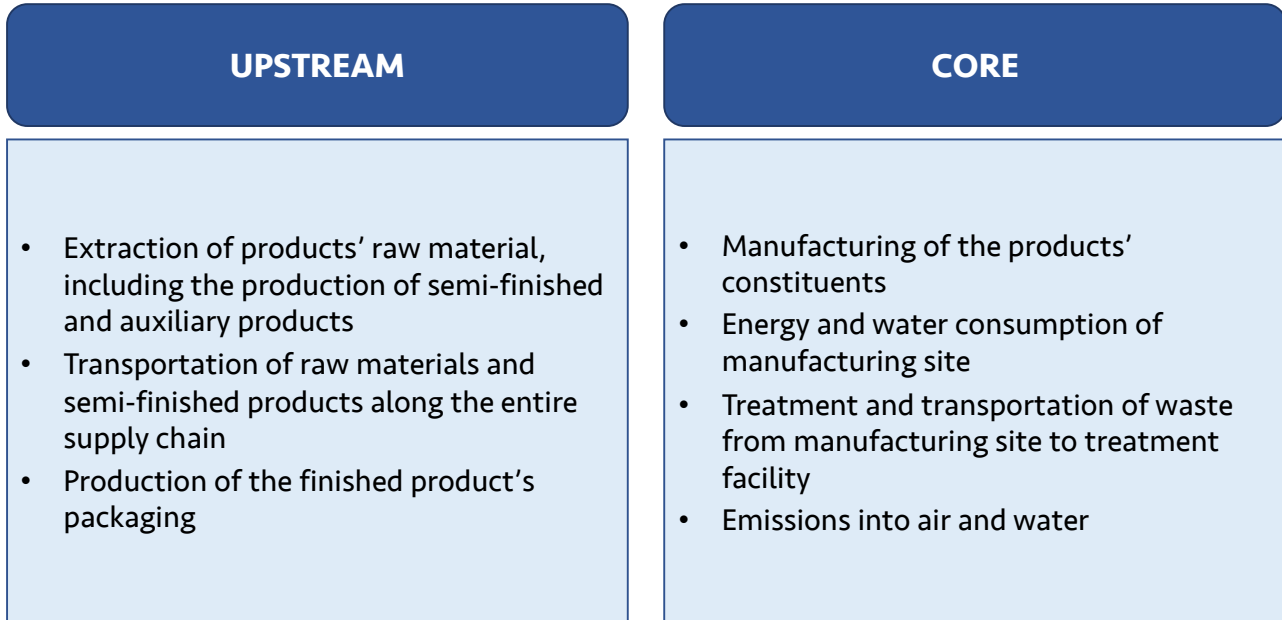


Figure 1 - System diagram illustrating the processes that are included in the product system, divided into upstream and core processes.

## 2. Upstream

The following attributional processes are part of the product system and classified as upstream processes:

- Extraction of products' raw material, including the production of semi-finished and auxiliary products;
- Transportation of raw materials (included auxiliary materials and packaging) and semi-finished products along the entire supply chain. In the event that assembly is done at several sites in series, transport between each site must be considered. If some production/assembly processes are outsourced to external companies, the transportation to and from the sites must be included.
- Manufacturing of the products' components;
- Production of the finished product's packaging, including packaging to distribute the PCBA in the reference market segment.

## 3. Core

The following attributional processes are part of the product system and classified as core processes:

- Manufacturing, assembly and testing of the products' constituents (including outsourced processes);
- Energy and water consumption of manufacturing site;
- Treatment and transportation of waste from manufacturing site to treatment facility;
- Emissions into air and water.

The technical system shall not include:

- Manufacturing of production equipment, buildings and other capital goods;
- Business travel of personnel;
- Travel to and from work by personnel;
- Research and development activities.





## DATA AND RULES FOR THE CFP STUDIES

1. Specific data or calculation rules
2. Cut-off rules
3. Allocation rules



## 1. Specific data or calculation rules

### 1.1 Specific data

A CFP calculation requires two different kinds of information:

- data related to the environmental aspects of the considered system (such materials or energy flows that enter the production system). These data shall come from the company that is performing the CFP calculation.
- data related to the life cycle impacts of the material or energy flows that enter the production system. Generic data can be used if specific data are not available.

Data on environmental aspects shall be as specific as possible and shall be representative of the studied process.

Data on the life cycle of materials or energy inputs are classified into three categories – specific data, selected generic data, and proxy data, defined as follows:

- **primary data** (also referred to as “site-specific data”) – data gathered from the actual manufacturing plant where product-specific processes are carried out, and data from other parts of the life cycle traced to the specific product system under study, e.g. materials or electricity provided by a contracted supplier that is able to provide data for the actual delivered services, transportation that takes place based on actual fuel consumption, and related emissions, etc.
- **secondary data** - data from commonly available data sources (e.g. commercial databases and free databases) that fulfill prescribed data quality characteristics for precision, completeness, and, proxy data from commonly available data sources (e.g. commercial databases and free databases) that do not fulfill all of the data quality characteristics of “selected generic data”.

As a general rule, specific data shall always be used, if available, after performing a data quality assessment.

The attributional LCA approach in Carbon Footprint Italy forms the basic prerequisites for selecting generic data. To allow the classification of generic data as “selected generic data”, they shall fulfill selected prescribed characteristics for precision, completeness, and representativeness (temporal, geographical, and technological), such as:

- the reference year must be as current as possible and preferably assessed to be representative for at least the validity period of the CFP,
- the cut-off criteria to be met on the level of the modelled product system are the qualitative coverage of at least 99% of energy, mass, and overall environmental relevance of the flows,

- completeness in which the inventory data set should, in principle, cover all elementary flows that contribute to a relevant degree of GHG emissions.

## 1.2 Calculation rules

The following requirements apply to the study:

- Data referring to processes and activities upstream in a supply chain over which an organisation has direct management control shall be specific and collected on site.
- Data referring to contractors that supply main parts, packaging, or main auxiliaries should be requested from the contractor as specific data, as well as infrastructure, where relevant.
- In case specific data is lacking, selected generic data may be used. If this is also lacking, proxy data may be used.
- For the electricity used in the processes, electricity production impacts shall be accounted for in this priority when specific data are used in the processes:
  1. Specific electricity mix as generated, or purchased, from an electricity supplier, demonstrated by a Guarantee of Origin (or similar, where reliability, traceability, and the avoidance of double-counting are ensured) as provided by the electricity supplier. If no specific mix is purchased, the residual electricity mix from the electricity supplier shall be used<sup>1</sup>.
  2. National residual electricity mix or residual electricity mix on the market
  3. National electricity production mix or electricity mix on the market.The mix of electricity used in upstream processes shall be documented in the CFP study report, where relevant.
- Transport from the final delivery point of raw materials, chemicals, main parts, and components (see above regarding upstream processes) to the manufacturing plant/place of service provision should be based on the actual transportation mode, distance from the supplier, and vehicle load, if available.
- Waste treatment processes of manufacturing waste should be based on specific data, if available.

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<sup>1</sup> The residual electricity mix is the mix when all contract-specific electricity that has been sold to other customers has been subtracted from the total production mix of the electricity supplier.



## 2. Cut-off rules

Data for elementary flows to and from the product system contributing to a minimum of 99% of the declared environmental impacts shall be included (not including processes that are explicitly outside the system boundary as described in the relevant Section).

The check for cut-off rules in a satisfactory way is through the combination of expert judgment based on experience of similar product systems and a sensitivity analysis in which it is possible to understand how the un-investigated input or output could affect the final results.

The following flows and operations may be cut-off:

- Production, use and disposal of the packaging of components and semi-finished intermediates.
- Additionally, what defined in 4.2.3.3 of EN50693 applies.

## 3. Allocation rules

The following stepwise procedure shall be applied for multifunctional products and multiproduct processes:

1. Allocation shall be avoided, if possible, by dividing the unit process into two or more sub-processes and collecting the environmental data related to these sub-processes.
2. If allocation cannot be avoided, the inputs and outputs of the system shall be partitioned between its different products or functions in a way that reflects the underlying physical relationships between them; i.e. they should reflect the way in which the inputs and outputs are changed by quantitative changes in the products or functions delivered by the system.
3. Where physical relationships alone cannot be established or used as the basis for allocation (or they are too time consuming), the most suitable allocation procedure shall be used and documented.

In accordance with other existing programme operators, the methodological choices for allocation for reuse, recycling and recovery have been set according to the polluter pays principle (PPP). This means that the generator of the waste shall carry the full climate impact until the point in the product's life cycle at which the waste is transported to a scrapyard or gate of a waste processing plant (collection site). The subsequent user of the waste shall carry the climate impact from the processing and refinement of the waste but not the impact caused in the "earlier" life cycles.

The allocation procedure for core processes shall be based on processing time. When this is not possible, the adoption of different allocation procedures shall be justified.



## PCR APPLICABILITY

1. Impact category indicator results
2. PCR use for EPD purpose



This document constitutes the Product Category Rules (PCR<sup>2</sup>) developed by Carbon Footprint Italy with a technical collaboration with EPDItaly ([www.epditaly.it/en](http://www.epditaly.it/en)) for the additional EPD impact categories.

The requirements described in this Product Category Rules (PCR) are specified in addition to the ones indicated in the ISO standard 14067. Therefore, both the PCR and the ISO 14067 requirements shall be fulfilled in order to register to Carbon Footprint Italy.

In fact, this PCR was conceived and developed for CFP studies. Anyway, it can also be used for EPD (Environmental Product Declaration); to do this, the additional specific regulations required by the programme operator selected for the EPD registration should be followed as well (see Section 4.2).

So, in this PCR only the parameter reported in Section “Impact category indicator results” shall be included.

## 1. Impact category indicator results

The present PCR is aimed at the development of CFP. Therefore, a special focus is on the “Global Warming Potential” indicator.

The specific GHG emissions and removals treatment in the CFP or partial CFP that shall be quantified and documented separately in the CFP study report are reported in the ISO 14067:2018, Table 1 of chapter 6.4.9.8.

Four GWP indicators shall be declared, which differentiates greenhouse gases depending on their origin: GWP-fossil, GWP-biogenic emissions, GWP-land use and land use change (dLUC), and GWP-biogenic removals, in accordance with the mentioned ISO 14067:2018 standard.

It should be noted that other impact categories can be relevant for the product category under assessment, other than the “Global Warming Potential” category. Therefore, in order to integrate the CFP results and to provide a broader view of the product environmental impacts, more impact categories shall be evaluated. The detail of this option are outlined in the following sections.

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<sup>2</sup> Product Category Rules (PCRs) are documents that provide the rules, requirements and guidelines for developing a CFP study for a specific product category. PCRs are necessary to ensure uniformity of methodological approach to studies and to allow comparability between CFP studies related to products of the same category. The PCR development process is described in the “PQ04 PCR development” procedure, which can be downloaded in the dedicated section of the website. This PCR follows the requirements of ISO/TS 14027, ISO 14067 and ISO 14025.

## 2. PCR use for EPD purpose

This PCR was conceived and developed for CFP studies. Anyway, it can also be used for EPD (Environmental Product Declaration); to do this, other predetermined parameters or extension of system boundary required by the programme operator selected for the EPD registration shall be followed. These parameters are:

- other impact category indicator results (see table 1 and following);
- inventory results that are elementary flows;
- data that do not represent elementary flows;
- additional environmental information.

About the extension of System Boundary, if the product is considered as electric/electrical product, its Life Cycle Assessment (LCA) shall be developed in conformity with EN 50693 with the following impact indicators (see table 1 and following).

More information could be found from EN 50693 or general PCR into EPDItaly System.

Impact category	Impact indicator	Unit of measurement
Climate change - total	Global Warming Potential total (GWP-total)	kg of CO <sub>2</sub> equivalent
Ozone Depletion	Depletion potential of the stratospheric ozone layer (ODP)	kg of CFC-11 equivalents
Acidification	Acidification potential, Accumulated Exceedance (AP)	moles of H <sup>+</sup> equivalents
Eutrophication of water	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg of P equivalent
Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine)	kg of N equivalent
Eutrophication terrestrial	Eutrophication potential, accumulated exceedance (EP-terrestrial)	mol of N equivalent
Photochemical ozone formation	Formation potential of tropospheric ozone (POCP)	kg of NMVOC equivalents
Depletion of abiotic resources - minerals and materials	Abiotic Depletion for non-fossil resources potential (ADP-minerals&metals)	kg of Sb equivalents
Depletion of abiotic resources - fossil resources	Abiotic Depletion for fossil resources potential (ADP-fossil)	MJ, calculated using net calorific values
Water use	Water deprivation potential, deprivation-weighted water consumption (WDP)	m <sup>3</sup> equivalents

TABLE 1: OTHER IMPACT CATEGORY



The environmental impact indicators must be determined using the characterisation factors and impact assessment methods specified in EN 15804:2012+A2:2019.

Parameters	Unit of measurement
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	MJ, net calorific value
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	MJ, net calorific value
Use of non-renewable primary energy resources used as raw material (PENRM)	MJ, net calorific value
Use of renewable primary energy resources used as raw material (PERM)	MJ, net calorific value
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	MJ, net calorific value
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	MJ, net calorific value
Net use of fresh water (FW)	m <sup>3</sup>
Use of secondary raw materials (MS)	kg
Use of renewable secondary fuels (RSF)	MJ
Use of non-renewable secondary fuels (NRSF)	MJ

TABLE 2: PARAMETERS DESCRIBING RESOURCE USE

Impact category	Unit of measurement
Hazardous landfill waste (HWD)	kg
Non-hazardous waste disposed (NHWD)	kg
Radioactive waste disposed (RWD)	kg
Materials for energy recovery (MER)	kg
Material for recycling (MFR)	kg
Components for reuse (CRU)	kg
Exported thermal energy (ETE)	MJ, net calorific value
Exported electricity energy (EEE)	MJ, net calorific value

TABLE 3: WASTE PRODUCTION DESCRIPTIVE PARAMETERS





## COMPLEMENTARY INFORMATION

1. PCR use within other programme operators
2. Glossary
3. Bibliography
4. Underlying studies
5. Other existing PCR



## 1. PCR use within other programme operators

Carbon Footprint Italy believes in the importance of sharing different existing experiences, and considers the different Programme Operators as organizations that cooperate for a global climate transition.

CFI maintains the copyright of the document to ensure that it is possible to publish, update when necessary, and available to all organisations to develop and register CFPs. Stakeholders participating in PCR development should be acknowledged in the final document and on the website.

This PCR can be openly used by each CFP or EPD Programme Operator, if the original source of the know-how is mentioned (namely, the “PCR 2021-0003”, developed by Carbon Footprint Italy).

## 2. Glossary

CO <sub>2</sub>	Carbon dioxide
CPC	Central product classification
CFI	Carbon Footprint Italy
CFP	Carbon Footprint of Products
GHG	Greenhouse gases
ISO	International Organization for Standardization
kg	kilogram
LCA	Life cycle assessment
PCR	Product Category Rules
UN	United Nations

## 3. Bibliography

EN (2019), EN 506993:2019, Product category rules for life cycle assessments of electronic and electrical products and systems

ISO (2000), ISO 14020:2000, Environmental labels and declarations – General principles

ISO (2017), ISO 14026:2017, Environmental labels and declarations – Principles, requirements and guidelines for communication of footprint information

ISO (2006b), ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework

ISO (2006c), ISO 14044: 2006, Environmental management – Life cycle assessment – Requirements and guidelines

ISO (2018), ISO 14067:2018, Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification

PCR EPDItaly 007 - Electronic and electrical products and systems, EPDItaly

PCR EPDItaly 015 - Switchboards, EPDItaly

PQ 04 PCR Development, Carbon Footprint Italy

## 4. Underlying studies

The methodological choices made during the development of this PCR (functional unit/declared unit, system boundary, allocation methods, impact categories, data quality rules, etc.) in this PCR were primarily based on the following underlying studies:

- *CFP Systematic Approach of SIT SpA products*, Aequilibria Srl – SB, 2021

## 5. Other existing PCR

As part of the development of this PCR, existing PCRs were considered in order to avoid overlaps in scope. The existence of such documents was checked in the public PCR listings of the following programmes based on ISO 14025 or similar:

- EPDItaly

The following existing PCRs were identified

PCR name	Programme	Registration number	Scope	Motivation for exclusion
SWITCHBOARDS	EPDItaly	15	UN CPC 46213 - 46214	The scope is not directly applicable to PCBAs.



<b>Programme operator:</b>	<b>Carbon Footprint Italy</b> P.le Martiri delle Foibe 5, 30175 Venezia Marghera, Venezia, Italy Website: <a href="http://www.carbonfootprintitaly.it/en/">www.carbonfootprintitaly.it/en/</a> E-mail: <a href="mailto:info@carbonfootprintitaly.it">info@carbonfootprintitaly.it</a>
<b>Product category:</b>	Printed circuit board assembly
<b>Registration number and version:</b>	2021-0003, version 1.0
<b>CPC classification code:</b>	46213
<b>Geographical scope:</b>	Global
<b>PCR moderator:</b>	Marta Mancin, Aequilibria Srl – SB, <a href="mailto:mmancin@aequilibria.com">mmancin@aequilibria.com</a>
<b>PCR Committee:</b>	SIT SpA; Aequilibria Srl – SB
<b>PCR Review panel</b>	The Technical-Scientific Committee of Carbon Footprint Italy and the technical support of EPDIItaly. The review panel may be contacted via <a href="mailto:info@carbonfootprintitaly.it">info@carbonfootprintitaly.it</a>
<b>PCR initiation phase:</b>	2021-06-29
<b>Open consultation:</b>	2021-12-23 – 2022-01-23
<b>Publication:</b>	2022-02-24
<b>Valid until:</b>	2027-02-23