Product Category Rules



Organic residues and waste material for energy production

UN CPC code: 39120, 39130, 39141, 39149, 39150, 39160, 39170, 39180, 34654

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PRODUCT CATEGORY

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1. Product category definition

This document provides Product Category Rules (PCR) for the assessment of the impact on climate change of organic waste material used in energy production.

The product category corresponds to the UN CPC code, defined under the UNSD-CPC Ver 2.1 classification:

	CODE	DESCRIPTION
Division	39	Wastes or scraps
Group	391	Wastes from food and tobacco industry
Class	3912	Bran and other residues from the working of cereals or legumes; vegetable materials and vegetable waste, vegetable residues and by- products, whether or not in the form of pellets, of a kind used in animal feeding n.e.c.
Sublass	**39120**	**Bran and other residues from the working of cereals or legumes; vegetable materials and vegetable waste, vegetable residues and by-products, whether or not in the form of pellets, of a kind used in animal feeding n.e.c.**
Class	3913	Residues of starch manufacture and similar residues
Subclass	**39130**	**Residues of starch manufacture and similar residues**
Class	3914	Beet-pulp, bagasse and other waste of sugar manufacture
Subclass	**39141**	**Bagasse**
Subclass	**39149**	**Beet-pulp and other waste of sugar manufacture**
Class	3915	Cocoa shells, husks, skins and other cocoa waste; coffee husks and skins
Subclass	**39150**	**Cocoa shells, husks, skins and other cocoa waste; coffee husks and skins**
Class	3916	Brewing or distilling dregs and waste
Subclass	**39160**	**Brewing or distilling dregs and waste**
Class	3917	Wine lees; argol
Subclass	**39170**	**Wine lees; argol**
Class	3918	Tobacco refuse
Subclass	**39180**	**Tobacco refuse**
Group	346	Fertilizers and pesticides
Class	3465	Other fertilizers
Subclass	**34654**	**Excreta of animals useful for manure/fertilizer and fuel preparation**

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 product covered by this PCR is organic waste material for energy production through anaerobic digestion.

These products are classified as “organic waste material”, to include in a common terminology the descriptions of the UN CPC codes involved.

3. Functional Unit

The functional unit is 1 kWh of net energy delivered to, and measured at, the customer's point of delivery, for one specified energy carrier (electricity, heat, steam, or cold). The results of different carriers are not comparable with each other. Losses upstream of the meter (including transmission and distribution) are included. Losses behind the meter are excluded.

The functional unit shall be stated in the CFP/EPD and include the description of the customer.
In the case of electricity, the customer shall be defined related to the voltage level where the meter is found

4. Declared Unit

In addition, it is possible to provide the result based on a declared unit. In this PCR the declared unit is defined as **1 tonne of organic residues and waste materials sent for energy production in a process such as anaerobic digestion, expressed in dry matter.**



SYSTEM BOUNDARIES

1. Diagram
2. Upstream
3. Core
4. Downstream
5. Extension of system boundaries

Carbon Footprint Italy follows an approach that includes 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-grave**.

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

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

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

1. Diagram

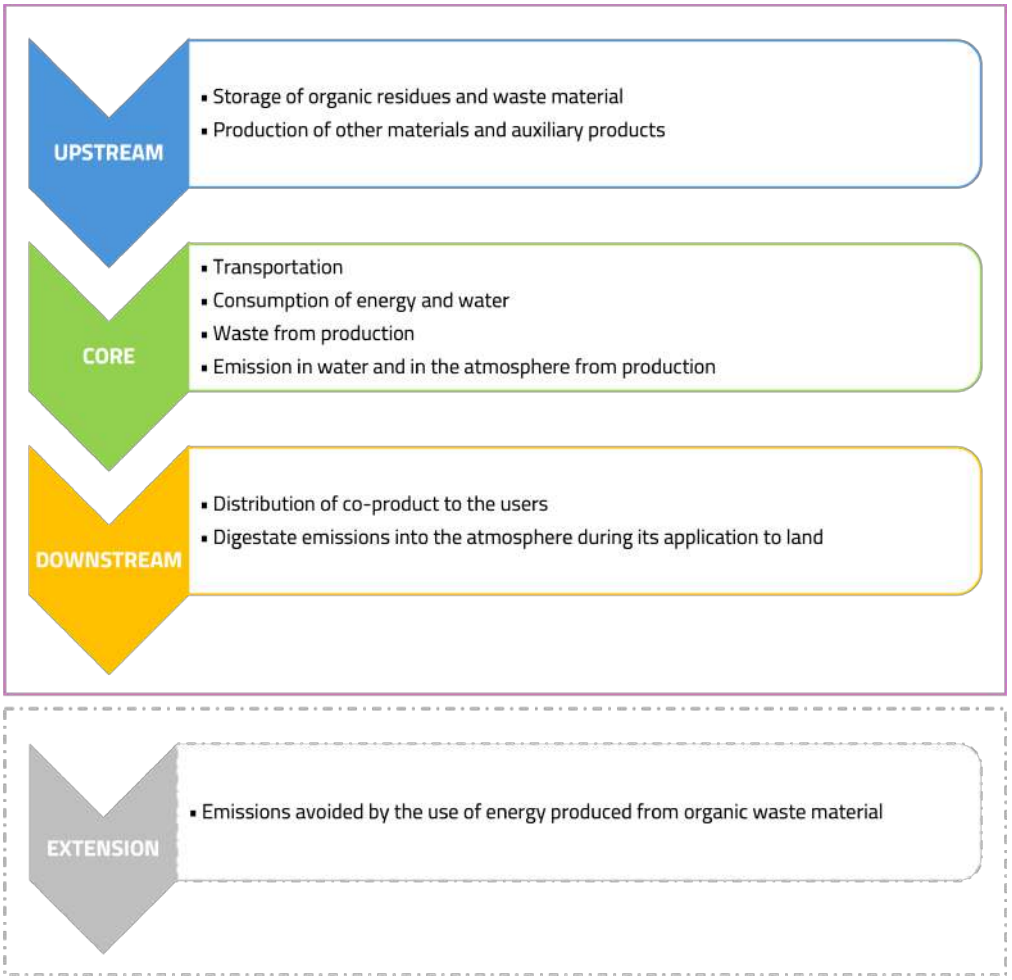

Figure 1 - System diagram illustrating the processes that are included in the product system, divided into upstream, core, downstream and extension of system boundaries.

2. Upstream

The following unit processes are part of the product system and shall be classified as upstream processes:

- Storage of organic residues and waste material (e.g. livestock manure, …) from the point at which they leave the generating process (for manure: removal from the animal housing area) until processing at the treatment plant, including on-farm storage, interim storage at the treatment plant and the related direct emissions (CH_4, direct and indirect N_2O)*;
- Production of auxiliary products used such as detergents for cleaning, etc..

** Emissions from on-farm storage shall be reported separately in the upstream module to allow the identification of potential overlaps with declarations of livestock products.*

Upstream processes not listed may also be included.

Please note that, in the absence of intervention, the emission value of cattle manure is equal to the values indicated below[1], as per laboratory analysis.

GHG emissions	182 gg	
	kg/year	g/kg dry matter
Nitrous oxide (N_20)	25,5	0,65
Methane (CH_4)	47,4	1,2
CO_2eq	8076	208

Table 1. Emission in absence of intervention

The use of these default factors (Table 1) is strongly recommended. The use of primary data related to these emissions is a sensitive aspect because it can influence the results of the study significantly. For this reason, the use of these primary data shall be justified and reported in the CFP report or EPD.

If the study is carried out considering different materials, it is necessary to use a supporting bibliographic study in order to indicate the correct data.

3. Core

The following unit processes are part of the product system and shall be classified as core processes:

- Transportation of the organic residues and waste material to the plant for energy production;
- Consumption of energy and water in the plant for energy production;

[1] The methodology for the quantification of emissions is based on "2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories".

- Waste produced in the plant for energy production;
- Direct emissions to air from the digestate (CH_4, direct and indirect N_2O) storage at the plant for energy production;
- Emissions to water and air from the plant for energy production, including methane losses from biogas processing, digestate storage, biogas upgrading, combustion in CHP units and flaring, quantified as described below.

Methane losses shall be quantified for each of the following sources, where present: biogas processing (digester, gas storage, piping, pressure relief valves and maintenance operations), digestate storage at the plant, biogas upgrading (off-gas), combustion in CHP units (unburned methane) and flaring.

Methane losses shall preferably be quantified on the basis of measured data (e.g. leak detection campaigns, measurement of the methane content and flow of the upgrading off-gas, exhaust gas measurements of the CHP unit, residual methane potential of the digestate).

Where measured data are not available, default values from recognized sources may be used, provided that they are representative of the technology actually used (e.g. open or gas-tight digestate storage, type of upgrading technology, presence of off-gas oxidation). Reference sources include the GHG calculation methodology of Directive (EU) 2018/2001, as amended, and the related JRC reports on methane emissions in the biogas and biomethane supply chains.

Reduced default values associated with best practices may only be applied where the related conditions are demonstrated (e.g. a documented leak detection and repair programme).

Methane losses shall be expressed as a percentage of the methane produced and converted into CO_2 equivalents using the GWP values prescribed in this PCR. The method, the values used for each source and their references shall be documented in the CFP report or EPD.

Core processes not listed may also be included, in compliance with the cut-off rules (see Section “Cut-off rules”).

The following processes shall not be included:

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

4. Downstream

The following processes are part of the product system and shall be classified as downstream processes:

- Distribution of the co-products of the plant to the users;

Any exclusion of life cycle stages and unit processes shall be justified.

5. System expansion

The benefits resulting from energy produced by the plant and exported to the grid or delivered to third parties may be calculated through system expansion. Energy consumed within the product system (self-consumption) shall not be credited.

These benefits shall be calculated and reported separately from the results of the impact assessment and shall not be subtracted from them.

For exported electricity, the substituted electricity shall be modelled using the national consumption grid mix of the country where the electricity is delivered, at the voltage level of the point of connection to the grid (e.g. *Electricity, medium voltage {IT} | market for*). The residual mix shall not be used. Since the consumption grid mix includes renewable sources, this choice leads to a conservative estimate of the benefits.

For other forms of exported energy, the substituted product shall be the equivalent fossil-based energy carrier, on an equal energy content basis, e.g.:

- exported heat substitutes heat produced from natural gas;
- biomethane injected into the grid or sold as fuel substitutes fossil natural gas.

If guarantees of origin or other energy attribute certificates are issued and sold for the exported energy, this shall be stated in the declaration.

No benefits shall be calculated for the substitution of mineral fertilisers by the digestate or by other co-products used as soil improvers or fertilisers, since the actual substitution depends on site-specific agronomic practices and cannot be verified with sufficient reliability.



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 two categories – primary data and secondary 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, primary data shall always be used, if available, after performing a data quality assessment.

The following data shall be primary data:

- composition of the feedstock, including the dry matter content (%) used for the calculation of the declared unit;
- on-farm storage of the feedstock (type of storage and duration); where the feedstock comes from multiple farms, representative data from a sample of supplying farms covering the majority of the input may be used;
- transport of the feedstock to the plant (distances and means of transport);
- energy consumption of the plant (electricity, heat and fuels);
- waste generated in the plant and its treatment (type, quantities and destination);

- direct emissions to air and water from the plant, measured or calculated from plant-specific parameters (e.g. storage type and duration, gas-tightness of tanks);
- quantity of digestate and other co-products produced;
- quantity of energy exported to the grid or delivered to third parties.

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 generic dataset shall cover at least 99% of the energy and mass flows of the modelled process and all flows of relevant environmental significance,
- 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.
- 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[2].
    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.

[2] 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.

- 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.

2. Cut-off rules

Elementary flows to and from the product system contributing to a minimum of 99% of the declared results shall be included, for each declared indicator (GWP-total in the case of a CFP; each declared core impact indicator in the case of an EPD). Processes explicitly excluded from the system boundary (see Section "System boundaries") are not subject to this rule.

The cut-off criterion is based on environmental relevance and not on mass or energy, since flows with negligible mass, such as CH_4 and N_2O emissions from storage, can give a significant contribution to the results.

Compliance with the cut-off rules shall be verified through expert judgement based on experience with similar product systems, supported by a sensitivity analysis showing how the excluded inputs and outputs could affect the final results.

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.

Where the plant includes cogeneration (combined heat and power), the allocation rules applied to electricity and heat shall be stated explicitly and justified in a transparent manner.

In accordance with other existing programme operators, the methodological choices for allocation for reuse, recycling and recovery follow the polluter pays principle (PPP). For this product category, the organic residues and waste material enter the product system free of burdens from the process that generated them. The boundary between the generating system and the product system is set at the point where the material leaves the generating process (for livestock manure: removal from the animal housing area). All subsequent processes, including on-farm storage, transport and interim storage at the plant, belong to the product system (see Section “Upstream”).



PCR APPLICABILITY

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

This document constitutes the Product Category Rules (PCR[3]) developed by Carbon Footprint Italy.

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 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, GHG-biogenic removals (uptake) and GWP-land use and land use change (dLUC), in accordance with the mentioned ISO 14067:2018 standard.

ISO 14067 details how to manage CO_2 uptake in biomass for cradle-to-grave studies. Indeed, clause 6.5.2 requires that "Removals of CO_2 into biomass shall be characterized in the LCIA as -1 kg CO_2e/kg CO2 in the calculation of the CFP when entering the product system. Emissions of biogenic CO_2 shall be characterized as +1 kg CO_2e/kg CO_2 of biogenic carbon in the calculation of the CFP". This implies the standardizer's intent to ensure that the benefit of CO_2 absorption (uptake) from biogenic processes is balanced by the emission occurring at the end-of-life stage.

The standard is very precise in indicating when requirements also apply to partial CFP studies; since the case of Partial CFP is not specified in this point, it is clear that requirement 6.5.2 must be understood as applicable only to "full" CFP studies.

This implies that for "full" CFP studies, the calculation method to be used IPCC 2021 GWP 100 (incl. CO2uptake), thus highlighting in which life cycle stages biogenic CO_2 removal occurs and in which stage the "offsetting" emission takes place (at end-of-life).

[3] 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.



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 is outlined in the following sections.

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 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.

Impact category	Impact indicator	Unit of measurement
Climate change - total	Global Warming Potential total (GWP-total)	kg of CO_2 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+ 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^3 equivalents

TABLE 1: OTHER IMPACT CATEGORY

The environmental impact indicators must be determined using the characterization 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^3
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 waste disposed (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 organizations 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 2025-0003", developed by Carbon Footprint Italy).

2. Glossary

CO_2	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

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 (2021), ISO 14040:2021, Environmental management – Life cycle assessment – Principles and framework

ISO (2021), ISO 14044: 2021, Environmental management – Life cycle assessment – Requirements and guidelines

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

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 Eco8 S.r.l.,* Aequilibria Srl – SB, 2025.

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:

- International EPD System
- EPDItaly

The following existing PCRs were identified:

PCR name	Programme	Registration number	Scope	Motivation for exclusion
ELECTRICITY, STEAM AND HOT/COLD WATER GENERATION AND DISTRIBUTION	International EPD System	2007:08	The product group includes electricity, steam and hot/cold water generated with any technology.	PCR 2007:08 covers electricity, steam and hot/cold water generation with any technology, but does not provide specific rules for energy production from organic residues and waste material.

Programme operator:	**Carbon Footprint Italy** Via Niccolò Tommaseo 17, 35131 Padova, Italy Website: www.carbonfootprintitaly.it/en/ E-mail: info@carbonfootprintitaly.it
Product category:	Organic residues and waste material for energy production
Registration number and version:	2025-0003, version 1.0
CPC classification code:	39120, 39130, 39141, 39149, 39150, 39160, 39170, 39180, 34654
Geographical scope:	Global
PCR moderator:	Marta Mancin, Aequilibria Srl – SB, mmancin@aequilibria.com
PCR Committee:	Aequilibria Srl-SB, Eco8 S.r.l.
PCR Review panel	The Technical-Scientific Committee of Carbon Footprint Italy. The review panel may be contacted via info@carbonfootprintitaly.it
PCR initiation phase:	01/07/2025
Open consultation:	22/09/2026
Publication:	16/10/2026
Valid until:	15/10/2031