
**Plastics — Carbon and environmental
footprint of biobased plastics —**

**Part 3:
Process carbon footprint,
requirements and guidelines for
quantification**

*Plastiques — Empreinte carbone et environnementale des plastiques
biosourcés —*

*Partie 3: Empreinte carbone des processus, exigences et lignes
directrices pour la quantification*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 14, *Environmental aspects*.

A list of all parts in the ISO 22526 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Increased use of biomass resources for manufacturing plastic products can be effective in reducing global warming and the depletion of fossil resources.

Current plastic products are composed of biobased synthetic polymers, fossil-based synthetic polymers, natural polymers and additives that can include biobased materials.

Biobased plastics refer to plastics that contain materials wholly or partly of biogenic origin.

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Plastics — Carbon and environmental footprint of biobased plastics —

Part 3:

Process carbon footprint, requirements and guidelines for quantification

1 Scope

This document specifies requirements and guidelines for the quantification and reporting of the process carbon footprint of biobased plastics (see ISO 22526-1), being a partial carbon footprint of a bioplastic product, based on ISO 14067 and consistent with International Standards on life cycle assessment (ISO 14040 and ISO 14044).

This document is applicable to process carbon footprint studies (P-CFP) of plastic materials, being a partial carbon footprint of a product, whether or not the results are intended to be publicly available.

Requirements and guidelines for the quantification of a partial carbon footprint of a product (partial CFP) are provided in this document. The process carbon footprint study is carried out according to ISO 14067 as a partial carbon footprint, using the specific conditions and requirements specified in this document.

Where the results of a P-CFP study are reported according to this document, procedures are provided to support transparency and credibility, and also to allow for informed choices.

Offsetting is outside of the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TS 14027, *Environmental labels and declarations — Development of product category rules*

ISO/TS 14071, *Environmental management — Life cycle assessment — Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006*

ISO 14044, *Environmental management — Life cycle assessment — Requirements and guidelines*

ISO 14050, *Environmental management — Vocabulary*

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

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14050, ISO 14067 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1.1

process carbon footprint of a product

process CFP

P-CFP

sum of greenhouse gas emissions and removals of the cradle-to-gate processes of a product system, expressed as CO₂ equivalents and based on the relevant stages or processes within the life cycle

Note 1 to entry: The process carbon footprint, being a partial CFP, is based on or compiled from the cradle-to-gate processes or information modules which are part of a product system and may form the basis for quantification of a P-CFP.

3.2 Abbreviated terms

CFP	carbon footprint of a product
P-CFP	Process carbon footprint of a product
CFP-PCR	carbon footprint of a product – product category rules
CO ₂ e	carbon dioxide equivalent
dLUC	direct land use change
GHG	greenhouse gas
GWP	global warming potential
iLUC	indirect land use change
IPCC	Intergovernmental Panel on Climate Change
LCA	life cycle assessment
LCIA	life cycle impact assessment
LCI	life cycle inventory analysis
LUC	land use change
PCR	product category rules

4 Application

In applying this document, it is advisable to take into consideration societal, environmental, legal, cultural, political and organizational diversity, as well as differences in economic conditions.

Further, it is not intended to provide a basis for trade regulations, legal actions, complaints, defences or other claims in any international, domestic or other proceeding, nor is it intended to be cited as evidence of the evolution of customary international law (adopted from ISO 26000).

Possible applications of this document include the provision of information for research and development of products, improvement of technologies and communication, where relevant.

5 Principles

5.1 General

The following principles are the basis for the subsequent requirements in this document.

5.2 Life cycle perspective, cradle to gate stage

The quantification of P-CFP takes into consideration all stages of the cradle-to-gate LCA of a product, including acquisition of raw materials, production, transportation/delivery, as applicable.

NOTE 1 Under certain conditions, partial CFPs can be added together to quantify the CFP (see [6.1](#)).

NOTE 2 By means of a systematic overview and life cycle perspective, the shifting of a potential impact between life cycle stages or individual processes can be identified and possibly avoided.

5.3 Relative approach and functional unit

The P-CFP study is structured around a declared unit and the results are calculated relative to this declared unit. See ISO 14040:2006, 4.1.4.

5.4 Iterative approach

An iterative approach of continuous reassessment as needed is taken when applying the four phases of LCA [goal and scope definition, life cycle inventory analysis (LCI), life cycle impact assessment (LCIA) and interpretation, see [6.1](#)] to a P-CFP study. The iterative approach will contribute to the consistency of the P-CFP study and the reported results. See ISO 14040:2006, 4.1.5.

5.5 Priority of approach

Preference to natural science (such as physics, chemistry, biology) is given when making decisions in P-CFP study. If this is not possible, other scientific approaches (such as social and economic) or approaches contained in conventions relevant and valid within the geographical scope as defined in [6.3](#) of this document are used. Only if neither a natural scientific basis exists nor a justification based on other approaches or international conventions is possible, decisions based on professional judgement are permitted.

See ISO 14040:2006, 4.1.8.

NOTE For information on allocation procedures, see ISO 14067:2018, 6.4.6.2.

5.6 Relevance

The selection of data and methods is appropriate to the assessment of the GHG emissions and removals arising from the product system being studied.

5.7 Completeness

All GHG emissions and removals that provide a significant contribution to the P-CFP of the product system being studied are included. The level of significance is determined by the cut-off criteria (see ISO 14067:2018, 6.3.4.3).

5.8 Consistency

Assumptions, methods and data are applied in the same way throughout the P-CFP study to arrive at conclusions in accordance with the goal and scope definition.

5.9 Coherence

Methodologies, standards and guidance documents that are already recognized and internationally adopted for product categories to enhance comparability between P-CFPs within any specific product category.

5.10 Accuracy

P-CFP quantification is accurate, verifiable, relevant and not misleading and that bias and uncertainties are reduced as far as is practical.

5.11 Transparency

All relevant issues are addressed and documented in an open, comprehensive and understandable presentation of information.

Any relevant assumptions are disclosed and methodologies and data sources used are appropriately referenced. Any estimates are clearly explained and bias is avoided so that the P-CFP study report faithfully represents what it purports to represent.

5.12 Avoidance of double-counting

Double-counting of GHG emissions and removals within the studied product system is avoided when the allocation of the same GHG emissions and removals occurs only once (see ISO 14067:2018, 6.4.6.1).

6 Methodology for CFP quantification

6.1 General

A P-CFP study according to this document shall include the four phases of LCA, i.e. goal and scope definition, LCI, LCIA, and interpretation according to ISO 14067 (see 6.3 to 6.5).

The unit processes comprising the product system shall be grouped into life cycle stages, e.g. raw material acquisition, production and distribution.

GHG emissions and removals from the product's life cycle shall be assigned to the life cycle stage in which the GHG emissions and removals occur.

Partial CFPs may be added together to quantify the CFP, provided that they are performed according to the same methodology for the same timeframe and that no gaps and overlaps exist.

NOTE 1 It is possible to have a partial CFP for a service, e.g. external testing.

NOTE 2 An organization might develop a CFP systematic approach, a set of procedures to facilitate the quantification of a P-CFP for two or more products by the same organization. For further information, see ISO 14067:2018, 3.1.1.3.

6.2 Use of CFP-PCR

For the use of CFP-PCR, the methodology for quantification of the CFP as specified in ISO 14067 shall be applied.

6.3 Goal and scope of the P-CFP quantification

For the following items the method as specified in ISO 14067 shall apply.

- Goal of a CFP study (see ISO 14067:2018, 6.3.1);
- Scope of a CFP study (see ISO 14067:2018, 6.3.2);

- Declared unit (see ISO 14067:2018, 6.3.3);
- System boundary (see ISO 14067:2018, 6.3.4);

The method as specified in ISO 14067 shall be applied where the P-CFP, being a partial CFP, shall consider stages from cradle to gate.

Where the assessment of the P-CFP is intended to be publicly available, the quantification of the P-CFP shall comprise the cradle-to-gate stage of the life cycle, if not otherwise specified.

- Data and data quality (see ISO 14067:2018, 6.3.5);
- Time boundary for data (see ISO 14067:2018, 6.3.6).

6.4 Life cycle inventory analysis for the P-CFP

The inventory analysis for the P-CFP is the phase of LCA involving the compilation and quantification of inputs and outputs for a product from cradle to gate throughout its life cycle.

If CFP-PCR are adopted for the P-CFP study, the inventory analysis shall be conducted according to the requirements in the CFP-PCR.

After the goal and scope definition phase, the inventory analysis of a P-CFP study shall be performed, consisting of the following steps, adapted from ISO 14044, when relevant.

- Data collection (see ISO 14067:2018, 6.4.2);
- Validation of data (see ISO 14067:2018, 6.4.3);
- Relating data to unit process and declared unit (see ISO 14067:2018, 6.4.4);
- Refining the system boundary (see ISO 14067:2018, 6.4.5);
- Allocation (see ISO 14067:2018, 6.4.6);
- P-CFP performance tracking (see ISO 14067:2018, 6.4.7);
- Time period for assessment of GHG emissions and removals (see ISO 14067:2018, 6.4.8);

GHG emissions and removals arising from the cradle to grave stage, shall be calculated and reported. Emissions and removals shall be included as if released or removed at the beginning of the assessment period.

- Treatment of specific GHG emissions and removals (ISO 14067:2018, 6.4.9).

An informative summary of the requirements and guidance is given in [Table 1](#). An informative illustration of the specific components of the P-CFP is given in [Figure 1](#). Refer to ISO 14067:2018, 6.4.9 for the full requirements and guidance.

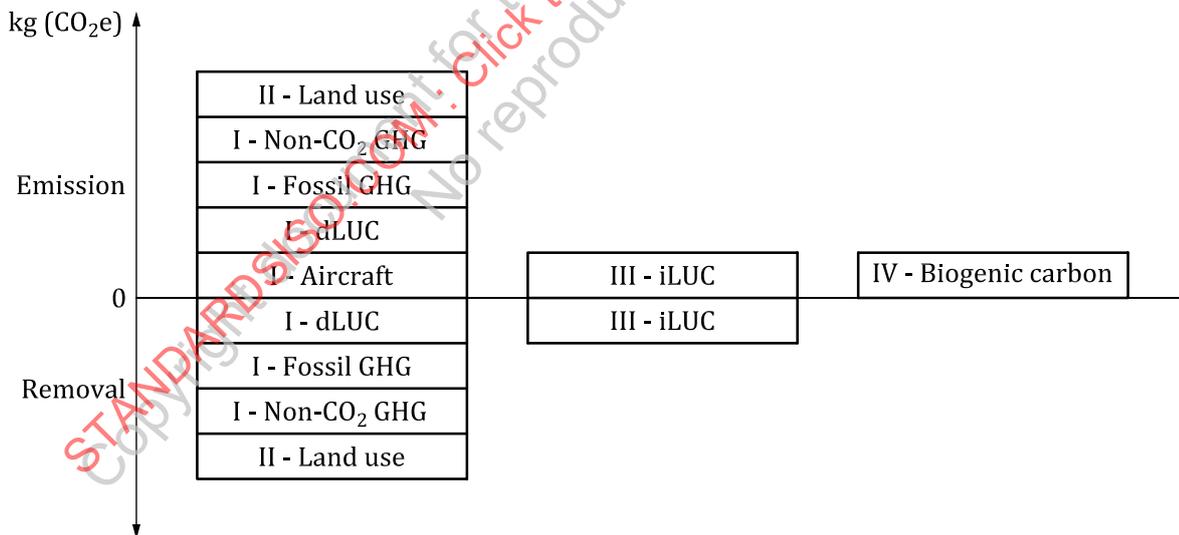
Table 1 — Specific GHG emissions and removals documented separately in the CFP and the CFP study report

ISO 14067 Subclause	Specific GHG emissions and Removals ^{a,c}	Treatment in the P-CFP			Documentation in the P-CFP study report	
		Shall be included in the P-CFP	Should be included in the P-CFP	Should be considered for inclusion in the P-CFP	Shall be documented separately in the P-CFP study report	Shall be documented separately in the P-CFP study report, if calculated
6.4.9.2	Fossil GHG emissions and removals ^b	X			X	
6.4.9.5	occurring as a result of dLUC ^b	X			X	
6.4.9.5	GHG emissions and removals occurring as a result of iLUC ^b			X		X
6.4.9.6	GHG emissions and removals from land use.		X			X
6.4.9.3	Biogenic carbon in products ^b					X
6.4.9.7	Aircraft GHG emissions	X			X	

^a The treatment of electricity shall be documented in the P-CFP study report, but GHG emissions and removals from electricity do not have to be documented separately in the P-CFP study report, see ISO 14067:2018, 6.4.9.3.

^b Effect of carbon storage is not included in the P-CFP. For reporting of timing of emissions and removals, see ISO 14067:2018, 6.4.8

^c Non-CO₂ GHG emissions and removals shall be included in the P-CFP but do not have to be documented separately in the P-CFP study report, see ISO 14067:2018, 6.4.9.7.



- Key**
- I shall be included in the CFP
 - II should be included in the CFP
 - III should be considered for inclusion in the CFP
 - IV shall be reported separately in the CFP study report

Figure 1 — Illustration of the specific components of the CFP

NOTE Fossil emissions and removals, dLUC and iLUC can have a positive or negative contribution to the CFP. Impact assessment for CFP or partial CFP.

6.5 Impact assessment

In the LCIA phase of a P-CFP study, the potential climate change impact of each GHG emitted and removed by the product system shall be calculated by multiplying the mass of GHG released or removed by the 100-year GWP given by the IPCC in units of “kg CO₂e per kg emission” (with carbon feedbacks).

Where GWP values are amended by the IPCC, the latest values shall be used in the CFP calculations if not otherwise stated and justified.

GWP for other time horizons, and/or GTP, as given by the IPCC, may be used in addition to GWP 100 but reported separately.

NOTE 1 100 year global warming potential (GWP 100) is used to represent short-term impacts of climate change. 100 year global temperature potential (GTP 100) is used as an indicator for the longer term impacts of climate change. There is no scientific basis for choosing a 100 year time horizon compared to other time horizons. The time horizon is a value judgement of international convention that weights the effects that are likely to occur over different time horizons – adapted text from IPCC, AR5, WG1, section 8.7.^[4]

Removals of CO₂ into biomass shall be characterized in the LCIA as -1 kg CO₂e/kg CO₂ in the calculation of the CFP when entering the product system.

Emissions of biogenic CO₂ shall be characterized as +1 kg CO₂e/kg CO₂ of biogenic carbon in the calculation of the CFP.

NOTE 2 The amount of CO₂ taken up in biomass and the equivalent amount of CO₂ emissions from the biomass at the point of complete oxidation results in zero net CO₂ emissions when biomass carbon is not converted into methane, non-methane volatile organic compounds (NMVOC) or other precursor gases.

For fossil and biogenic methane, the characterization factors in accordance with the most recent IPCC report shall be used.

6.6 Interpretation phase

The interpretation phase of a P-CFP study shall comprise the following steps:

- a) identification of the significant issues based on the results of the quantification of the P-CFP according to LCI and LCIA phases;
- b) an evaluation that considers completeness, sensitivity and consistency checks;
- c) conclusions, limitations, and recommendations.

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

- include a quantitative and/or qualitative assessment of uncertainty, including the application of rounding rules or ranges;
- identify and document the selected allocation methods in the P-CFP study report in detail;
- identify the limitations of the P-CFP study (see ISO 14067:2018, Annex A).

The interpretation should include:

- a sensitivity analysis of the significant inputs, outputs and methodological choices, including allocation methods, in order to understand the sensitivity and uncertainty of the results;
- an assessment of the influence of alternative use profiles on the final result; and
- an assessment of the consequences of recommendations [6.6 c)] on the final result.

7 CFP study report

7.1 General

A P-CFP study report addresses a partial CFP. The purpose of the P-CFP study report is to document the results of the quantification of the P-CFP study, and to demonstrate that the provisions of this document have been met.

The results and conclusions of the P-CFP study shall be documented in the P-CFP study report without bias.

The results, data, methods, assumptions, and the interpretation (see 6.6) shall be transparent and presented in sufficient detail to allow the reader to comprehend the complexities and trade-offs inherent in the P-CFP study.

The type and format of the P-CFP study report shall be defined in the goal and scope definition phase of the P-CFP study. The P-CFP study report shall also allow the results and interpretation to be used in a manner consistent with the goals of the study.

Results reported in CFP study report may be used in footprint communications (see ISO 14026) and as a part of a CFP study.

7.2 GHG values in the P-CFP study report

Results of the quantification of the CFP or partial CFP shall be documented in the CFP study report in mass of CO₂e per functional or declared unit.

The following GHG values shall be documented separately in the P-CFP study report:

- a) GHG emissions and removals linked to the main life cycle stages in which they occur, including the absolute and the relative contribution of each life cycle stage;
- b) net fossil GHG emissions and removals (see ISO 14067:2018, 6.4.9.2);
- c) GHG emissions and removals resulting from dLUC (see ISO 14067:2018, 6.4.9.4);
- d) GHG emissions resulting from all transportation (see ISO 14040:2006, 5.2.3).

The following GHG values shall be documented separately in the P-CFP study report, if calculated:

- 1) GHG emissions and removals occurring as a result of iLUC (see ISO 14067:2018, 6.4.9.4);
- 2) GHG emissions and removals occurring as a result of land use (see ISO 14067:2018, 6.4.9.5)
- 3) Results of the sensitivity analysis applying the relevant consumption grid mix when applicable; and
- 4) biogenic carbon content of products.

7.3 Required information for the CFP study report

In addition to the items above, the following items shall be included in the P-CFP study report:

- a) declared unit and reference flow (see ISO 14067:2018, 6.3.3);
- b) system boundary, including:
 - type of inputs and outputs of the system as elementary flows;
 - decision criteria concerning treatment of unit processes, considering their importance for the conclusions of the P-CFP study;
- c) list of important unit processes;