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Bioizdelki - Ocenjevanje življenjskega cikla

Bio-based products - Life Cycle Assessment

Biobasierte Produkte - Ökobilanzen

Produits biosourcés - Analyse du cycle de vie

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Bio-based products - Life Cycle Assessment

Produits biosourcés - Analyse du cycle de vie

Biobasierte Produkte - Ökobilanzen

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European foreword

This document (EN 16760:2015) has been prepared by Technical Committee CEN/TC 411 “Bio-based products”, the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2016, and conflicting national standards shall be withdrawn at the latest by May 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Bio-based products from forestry and agriculture have a long history of application, such as paper, board and various chemicals and materials. The last decades have seen the emergence of new bio-based products in the market. Some of the reasons for the increased interest lie in the bio-based products' benefits in relation to the depletion of fossil resources and climate change. Bio-based products may also provide additional product functionalities. This has triggered a wave of innovation with the development of knowledge and technologies allowing new transformation processes and product development.

Acknowledging the need for common standards for bio-based products, the European Commission issued mandate M/492[1], resulting in a series of standards developed by CEN/TC 411, with a focus on bio-based products other than food, feed and biomass for energy applications.

The standards of CEN/TC 411 "Bio-based products" provide a common basis on the following aspects:

— Common terminology;

— Bio-based content determination;

— Life Cycle Assessment (LCA);

— Sustainability aspects;

— Declaration tools.

It is important to understand what the term bio-based product covers and how it is being used. The term 'bio-based' means 'derived from biomass'. Bio-based products (bottles, insulation materials, wood and wood products, paper, solvents, chemical intermediates, composite materials, et cetera) are products which are wholly or partly derived from biomass. It is essential to characterize the amount of biomass contained in the product by for instance its bio-based content or bio-based carbon content.

The bio-based content of a product does not provide information on its environmental impact or sustainability, which may be assessed through LCA and sustainability criteria. In addition, transparent and unambiguous communication within bio-based value chains is facilitated by a harmonized framework for certification and declaration.

This European Standard aims to provide specific life cycle assessment requirements and guidance for bio-based products, based on EN ISO 14040 *Environmental management — Life cycle assessment — Principles and framework* and EN ISO 14044 *Environmental management — Life cycle assessment — Requirements and guidelines*.

Though the scope of CEN/TC 411 excludes food, feed and energy, life cycle assessment of biomass and bio-based products should follow the same principles irrespective of their use.

This European Standard informs and guides life cycle assessment and applications including for example Product Category Rules (PCR). An LCA assessment carried out according to this standard can be used as a basis to assess certain criteria as laid down in prEN 16751.

[1] A Mandate is a standardization task embedded in European trade laws. M/492 Mandate is addressed to the European Standardization bodies, CEN, CENELEC and ETSI, for the development of horizontal European Standards for bio-based products.

1 Scope

This European Standard provides specific life cycle assessment (LCA) requirements and guidance for bio-based products, excluding food, feed and energy, based on EN ISO 14040 and EN ISO 14044.

This European Standard covers bio-based products, derived wholly or partly from biomass.

This European Standard provides guidance and requirements to assess impact over the life cycle of bio-based products with the focus on how to handle the specificities of the bio-based part of the product.

The applications of LCA as such are outside the scope of this European Standard. Clarifications, considerations, practices, simplifications and options for the different applications, are also beyond the scope of this European Standard. In addition, this European Standard may be applied in studies that do not cover the whole life cycle, with justification e.g. in the case of business-to-business information, such as cradle-to-gate studies, gate-to-gate studies, and specific parts of the life cycle (e.g. waste management, components of a product).

2 Normative references

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

EN 16575, *Bio-based products - Vocabulary*

EN ISO 14025, *Environmental labels and declarations - Type III environmental declarations - Principles and procedures (ISO 14025)*

EN ISO 14040:2006, *Environmental management - Life cycle assessment - Principles and framework (ISO 14040:2006)*

EN ISO 14044:2006, *Environmental management - Life cycle assessment - Requirements and guidelines (ISO 14044:2006)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16575, EN ISO 14040 and EN ISO 14044 apply.

4 Methodology for LCA of bio-based products

4.1 General description of an LCA

The general description of life cycle assessment is defined in EN ISO 14040:2006, Clause 4, with 4.1 *Principles of LCA*, 4.2 *Phases of an LCA*, 4.3 *Key features of an LCA*, 4.4 *Product system*.

4.2 General aspects of LCA for bio-based products

The LCA of a bio-based product shall cover the whole product, not only its bio-based part, see Figure 1. However, the focus of this European Standard is on how to handle the specificities of the bio-based part of the product.

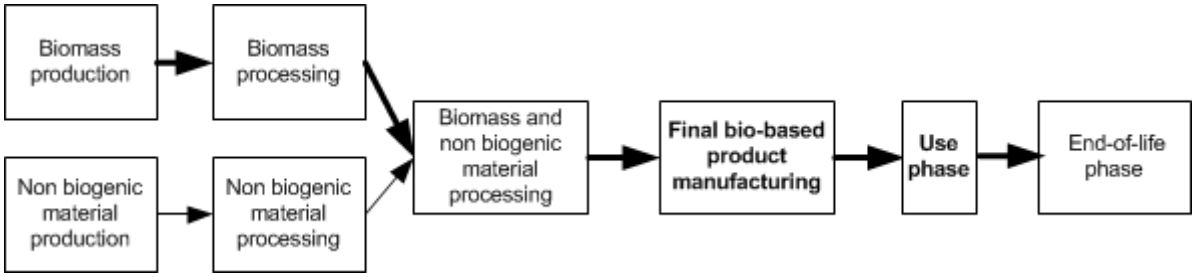

Figure 1 — Example of a product system of a bio-based product which includes biomass as well as non-biogenic material feedstocks

NOTE 1 The boxes linked with bold arrows in Figure 1 represent the flows of bio-based products (partly or fully derived from biomass) that can be raw materials, intermediary products and final product.

NOTE 2 For simplification purposes, transportation steps have not been reported in Figure 1, but transportation can occur between any of the unit processes.

This European Standard provides additional requirements and guidelines for bio-based products on: Goal and scope (see 4.3), Life Cycle Inventory - LCI (see Clause 5), Life Cycle Impact Assessment - LCIA (see Clause 6) and Interpretation and reporting (see Clause 7).

An LCA for a bio-based product shall include the four phases of LCA. LCA requirements and guidelines are provided in EN ISO 14044:2006, 4.2, 4.3, 4.4 and 4.5.

This European Standard provides further guidance on the following, which can be important for bio-based products, due to their biomass origin:

— geographical (see 5.2.2) and temporal scope (see 5.2.3) to be representative for the biomass acquisition phase considering agricultural, forest and aquaculture specificities;

— allocation procedures (see 5.3) as the production stages typically generates co-products;

— consideration for resource elementary flows (see 5.4.1);

— data collection and modelling for land use (see 5.4.2), water use (see 5.4.3), and fossil and biogenic carbon flows (see 5.5);

— modelling of agriculture, forestry and aquaculture systems (see 5.6); and

— inventory and modelling requirements for bio-based products end-of-life (see 5.6.4).

This series of European Standards focuses on bio-based products for industrial applications; food, feed and energy are excluded from the scope. However the guidelines and requirements for LCA provided in this standard can be applied to any product derived from biomass, irrespective of the application.

4.3 Goal and Scope of the LCA study

4.3.1 Goal of the LCA study

When defining the goal and scope of the LCA study, the requirements of EN ISO 14040:2006, 5.2.1 and EN ISO 14044:2006, 4.2.2 and 4.2.3 shall apply.

There is no single solution as to how LCA can best be applied, it will depend on the goal of the LCA and on each organization's size, its products, the strategy, the internal systems, tools and procedures and the external drivers.

In defining the goal of an LCA, the following items shall be unambiguously stated:

— the intended application of the study;

— the reasons for carrying out the study;

— the intended audience, i.e. to whom the results of the study are intended to be communicated; and

— whether the results are intended to be used in comparative assertions intended to be disclosed to the public.

4.3.2 Scope of the LCA study

4.3.2.1 General

The scope should be sufficiently well defined to ensure that the breadth, depth and detail of the study are compatible and sufficient to address the stated goal. In addition to the definition of the scope of the LCA study in EN ISO 14044:2006, 4.2.3, the limitations, assumptions and methods to assess issues specific to bio-based products should be explained (e.g. assumptions for use stage, for end-of–life stage, carbon storage)

In some cases, the goal and scope of the study may be revised due to unforeseen limitations, constraints or as a result of additional information. Such modifications, together with their justification, should be documented. It shall be determined which impact categories, category indicators and characterization models are included within the LCA study. The selection of impact categories, category indicators and characterization models used in the LCIA methodology shall be consistent with the goal of the study and considered as described in EN ISO 14044:2006, 4.4.2.2.

Any technical input to establish and manage the system producing the biomass is considered within the system boundary and thus part of the LCA of the bio-based material.

4.3.2.2 Function, functional unit and reference flows

In defining the functional unit, the requirements of EN ISO 14040:2006, 5.2.2 and EN ISO 14044:2006, 4.2.3.2 shall apply.

The scope of an LCA shall clearly specify the functions (performance characteristics) of the product system being studied. The functional unit shall be consistent with the goal and scope of the study. One of the primary purposes of a functional unit is to provide a reference to which the input and output data are related. This reference is necessary to ensure a common basis for comparability of LCA results, in particular when different systems are being assessed. Therefore the functional unit shall be clearly defined and measurable. An appropriate reference flow shall be determined in relation to the functional unit. The quantitative input and output data collected in support of the analysis shall be calculated in relation to this flow. For bio-based products which are intermediates or which can serve several functions or service, it is recommended to use a reference flow such as weight or volume (e.g. 1kg of product), and to provide information whether it refers to dry matter weight, gross weight, etc.

EXAMPLE In the function of drying hands, both a paper towel and an air-dryer system are studied. The selected functional unit may be expressed in terms of the identical number of pairs of hands dried for both systems. For each system, it is possible to determine the reference flow, e.g. the average mass of paper or the average volume of hot air required for one pair of hand-dry, respectively. For both systems, it is possible to compile an inventory of inputs and outputs on the basis of the reference flows. At its simplest level, in the case of paper towel, this would be related to the paper consumed. In the case of the air-dryer, this would be related to the mass of hot air needed to dry the hands (copied from EN ISO 14040:2006, 5.2.2).

4.3.2.3 System boundary

In defining the system boundary, the requirements of EN ISO 14040:2006, 5.2.3 and EN ISO 14044:2006, 4.2.3.3 shall apply.

The system boundary shall be explained clearly and in an unambiguous way, preferably in a flow chart figure. The exclusion of any life cycle stages shall be documented and explained.

LCA technique with proper justification may be applied in studies that are not LCA or LCI studies. Examples are:

— cradle-to-gate studies;

— gate-to-gate studies; and

— specific parts of the life cycle (e.g. waste management, components of a product).

4.3.2.4 Cut-off criteria

When using cut-off criteria to decide on inclusion of inputs and outputs, the requirements of EN ISO 14044:2006, 4.2.3.3.3 shall apply.

The choice of elements of the physical system to be modelled depends on the goal and scope definition of the study, its intended application and audience, the assumptions made, data and cost constraints, and cut-off criteria. The models used should be described and the assumptions underlying those choices should be identified. The cut-off criteria used within a study should be clearly understood and defined within the goal and scope definition phase. The effect on the outcome of the study of the cut-off criteria selected shall also be assessed and described in the final report.

In principle, all elementary and technosphere flows should be accounted for. If not, mass, energy and environmental significance should be used to determine cut-off criteria. The final report shall include an estimation of completeness, based on:

— Mass (in % of total product mass): best estimation of the mass all non-accounted components of the product.

— Energy (in % of total energy consumption): best estimation of all energy consumption of non-accounted mass inputs.

— Environmental significance: decisions on cut-off criteria should be based on relevant information about the environmental impacts. Such information may e.g. be sought on Safety Data Sheets for toxicological and ecotoxicological effects of a product where substance classification can guide on possible cut-offs regarding such categories. For the assessment of other relevant environmental impacts also other sources of information should be looked for, e.g. emission declarations, approval documentation, etc. Inputs such as transport of staff, or consumer transport may be excluded where it is established that they are insignificant.

Such simplifications shall be explicitly stated in the study report along with any supporting documentation showing these calculations, specifying the names of any flows which have not been taken into consideration.

4.3.2.5 LCIA methodology and types of impacts

It shall be determined which impact categories, category indicators and characterization models are included within the LCA study. The selection of impact categories, category indicators and characterization models used in the LCIA methodology shall be consistent with the goal of the study and considered as described in EN ISO 14044:2006, 4.4.2.2.

NOTE This text is copied from EN ISO 14044:2006, 4.2.3.4.

4.3.2.6 Data quality

Data quality requirements shall be specified to enable the goal and scope of the LCA to be met and should address what is listed in EN ISO 14044:2006, 4.2.3.6.2 and 4.2.3.6.3.

Site-specific, primary and secondary data should be used as appropriate and in line with the goal and scope of the study. The selection of level of geographical detail should be consistent with the goal and intended use of the LCA and be justified in view of the availability and quality of data.

4.3.2.7 Comparisons between systems

As this European Standard provides additional guidance and requirements for bio-based products, the equivalence of the systems being compared shall be evaluated before interpreting the results. Consequently, the scope of the study shall be defined in such a way that the systems can be compared. Systems shall be compared using the same functional unit and equivalent methodological considerations, such as system boundary, data quality, allocation procedures, decision rules on evaluating inputs, and outputs and impact assessment. Any differences between systems regarding these parameters shall be identified and reported. If the study is intended to be used for a comparative assertion intended to be disclosed to the public, interested parties shall conduct this evaluation as a critical review.

A life cycle impact assessment shall be performed for studies intended to be used in comparative assertions intended to be disclosed to the public.

If comparative assertions are intended to be disclosed to the public, additional requirements as set in EN ISO 14044:2006 apply.

5 LCI – Life Cycle Inventory

5.1 General

Inventory analysis involves data collection and calculation procedures to quantify relevant inputs and outputs of a product system.

The process of conducting an inventory analysis is iterative. As data are collected and more is learned about the system, new data requirements or limitations may be identified that require a change in the data collection procedures so that the goals of the study will still be met. Sometimes, issues may be identified that require revisions to the goal or scope of the study.

The qualitative and quantitative data for inclusion in the inventory shall be collected for each unit process that is included within the system boundary. The collected data, whether measured, calculated or estimated, are utilized to quantify the inputs and outputs of a unit process.

When data have been collected from public sources, the source shall be referenced. For those data that can be significant for the conclusions of the study, details about the relevant data collection process, the time when data have been collected, and further information about data quality indicators shall be referenced.

If such data do not meet the data quality requirements, this shall be stated.

To decrease the risk of misunderstandings (e.g. resulting in double counting when validating or reusing the data collected), a description of each unit process shall be recorded.

Since data collection may span several reporting locations and published references, measures should be taken to reach uniform and consistent understanding of the product systems to be modelled.