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Environmental management — Eco-efficiency assessment of product systems — Principles, requirements and guidelines

Management environnemental — Évaluation de l'écoefficacité des systèmes de produits — Principes, exigences et lignes directrices

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Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 14045 was prepared by Technical Committee ISO/TC 207, *Environmental management*, Subcommittee SC 5, *Life cycle assessment*.

This corrected version of ISO 14045:2012 incorporates the following corrections:

— (page 20) correction of “LCIA” to “LCI” in B.3.2.2, item 5, first bullet, first sentence;

— (page 37) correction of “Another advantage of A and B...” to “Another advantage of A and C...” in B.5.5.2, first bullet, third sentence.

Introduction

Eco-efficiency assessment is a quantitative management tool which enables the study of life-cycle environmental impacts of a product system along with its product system value for a stakeholder.

Within eco-efficiency assessment, environmental impacts are evaluated using Life Cycle Assessment (LCA) as prescribed by other International Standards (ISO 14040, ISO 14044). Consequently, eco-efficiency assessment shares with LCA many important principles such as life cycle perspective, comprehensiveness, functional unit approach, iterative nature, transparency and priority of a scientific approach.

The value of the product system may be chosen to reflect, for example, its resource, production, delivery or use efficiency, or a combination of these. The value may be expressed in monetary terms or other value aspects.

The key objectives of this International Standard are to:

— establish clear terminology and a common methodological framework for eco-efficiency assessment;

— enable the practical use of eco-efficiency assessment for a wide range of product (including service) systems;

— provide clear guidance on the interpretation of eco-efficiency assessment results;

— encourage the transparent, accurate and informative reporting of eco-efficiency assessment results.

Environmental management — Eco-efficiency assessment of product systems — Principles, requirements and guidelines

1 Scope

This International Standard describes the principles, requirements and guidelines for eco-efficiency assessment for product systems, including:

a) the goal and scope definition of the eco-efficiency assessment;

b) the environmental assessment;

c) the product system value assessment;

d) the quantification of eco-efficiency;

e) interpretation (including quality assurance);

f) reporting;

g) critical review of the eco-efficiency assessment.

Requirements, recommendations and guidelines for specific choices of categories of environmental impact and values are not included. The intended application of the eco-efficiency assessment is considered during the goal and scope definition phase, but the actual use of the results is outside the scope of this International Standard.

2 Normative references

The following referenced documents are indispensable for the application 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 14040:2006, *Environmental management — Life cycle assessment — Principles and framework*

ISO 14044:2006, *Environmental management — Life cycle assessment — Requirements and guidelines*

ISO 14050:2009, *Environmental management — Vocabulary*

3 Terms and definitions

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

3.1
product
any goods or service

[SOURCE: ISO 14021:1999, 3.1.11]

3.2
product flow
products (3.1) entering from or leaving to another product system

[SOURCE: ISO 14040:2006, 3.27]

3.3
product system
collection of unit processes with elementary and *product flows* (3.2), performing one or more defined functions, and which models the life cycle of a *product* (3.1)

[SOURCE: ISO 14040:2006, 3.28]

3.4
environmental aspect
element of an organization's activities or products or services that can interact with the environment

Note 1 to entry: A significant environmental aspect has or can have a significant environmental impact.

[SOURCE: ISO 14001:2004, 3.6]

3.5
environmental performance
measurable results related to *environmental aspects* (3.4)

3.6
eco-efficiency
aspect of sustainability relating the *environmental performance* (3.5) of a *product system* (3.3) to its *product system value* (3.7)

3.7
product system value
worth or desirability ascribed to a *product system* (3.3)

Note 1 to entry: The product system value may encompass different value aspects, including functional, monetary, aesthetic, etc.

3.8
product system value indicator
numerical quantity representing the *product system value* (3.7)

Note 1 to entry: To express the product system value indicator, various kinds of units such as physical and monetary units or relative gradings and scoring may be used.

3.9
eco-efficiency indicator
measure relating *environmental performance* (3.5) of a *product system* (3.3) to its *product system value* (3.7)

3.10
eco-efficiency profile
eco-efficiency (3.6) assessment results relating the life cycle impact assessment results to the *product system value* (3.7) assessment results

3.11
weighting factor
<eco-efficiency> factor derived from a weighting model, which is applied to convert an assigned life cycle inventory result, a life cycle impact category indicator result, or a product system value indicator to the common unit of the weighting indicator

3.12
sensitivity analysis
systematic procedures for estimating the effects of the choices made regarding methods and data on the outcome of a study

[SOURCE: ISO 14040:2006, 3.31]

3.13
uncertainty analysis
systematic procedure to quantify the uncertainty in the results of a life cycle inventory analysis and/or product system value assessment due to the cumulative effects of model imprecision, input uncertainty and data variability

Note 1 to entry: Either ranges or probability distributions are used to determine uncertainty in the results.

[SOURCE: ISO 14040:2006, 3.33, modified — "and/or product system value assessment" has been inserted.]

3.14
unit process
smallest element considered in the life cycle inventory analysis or product system value assessment for which input and output data are quantified

[SOURCE: ISO 14040:2006, 3.34, modified — "or product system value assessment" has been inserted.]

3.15
critical review
<eco-efficiency> process intended to ensure consistency between an *eco-efficiency* (3.6) assessment and the principles and requirements of the International Standards on eco-efficiency assessment

[SOURCE: ISO 14040:2006, 3.45, modified — "Life cycle assessment" has been replaced by "eco-efficiency assessment".]

3.16
comparative eco-efficiency assertion
claim in *eco-efficiency* (3.6) regarding the superiority or equivalence of one *product* (3.1) versus a competitor's *product* that performs the same function

Note 1 to entry: This definition does not interpret, change, or subtract from the requirements of ISO 14044 on comparative assertions.

4 General description of eco-efficiency

4.1 Principles of eco-efficiency

4.1.1 General

The following principles are fundamental and serve as guidance for decisions relating to both the planning and the conducting of an eco-efficiency assessment.

4.1.2 Life cycle perspective

An eco-efficiency assessment considers the entire life cycle from raw material extraction and acquisition, through energy and material production and manufacturing, to use and end-of-life treatment and final disposal. Through such a systematic overview and perspective, the shifting of a potential impact between life cycle stages or individual processes can be identified and assessed with a view to an overall eco-efficiency.

4.1.3 Iterative approach

Eco-efficiency assessment is an iterative technique. The individual phases of an eco-efficiency assessment (see Figure 1) use results of the other phases. The iterative approach within and between the phases contributes to the comprehensiveness and consistency of the eco-efficiency assessment and the reported results.

4.1.4 Transparency

Due to the inherent complexity in eco-efficiency assessment, transparency is an important guiding principle in executing an eco-efficiency assessment, in order to ensure a proper interpretation of the results.

4.1.5 Comprehensiveness

An eco-efficiency assessment considers all attributes and aspects of environment and product system value. By considering all attributes and aspects within one eco-efficiency assessment, potential trade-offs can be identified and assessed.

4.1.6 Priority of scientific approach

Decisions within an eco-efficiency assessment are preferably based on scientific data, methodology and other evidence. If this is not possible, decisions based on international conventions may be used. If neither a scientific basis exists nor international conventions can be referred to, then decisions may be based on value choices.

4.2 Phases of an eco-efficiency assessment

An eco-efficiency assessment comprises five phases:

a) goal and scope definition (including system boundaries, interpretation and limitations);

b) environmental assessment;

c) product system value assessment;

d) quantification of eco-efficiency;

e) interpretation (including quality assurance).

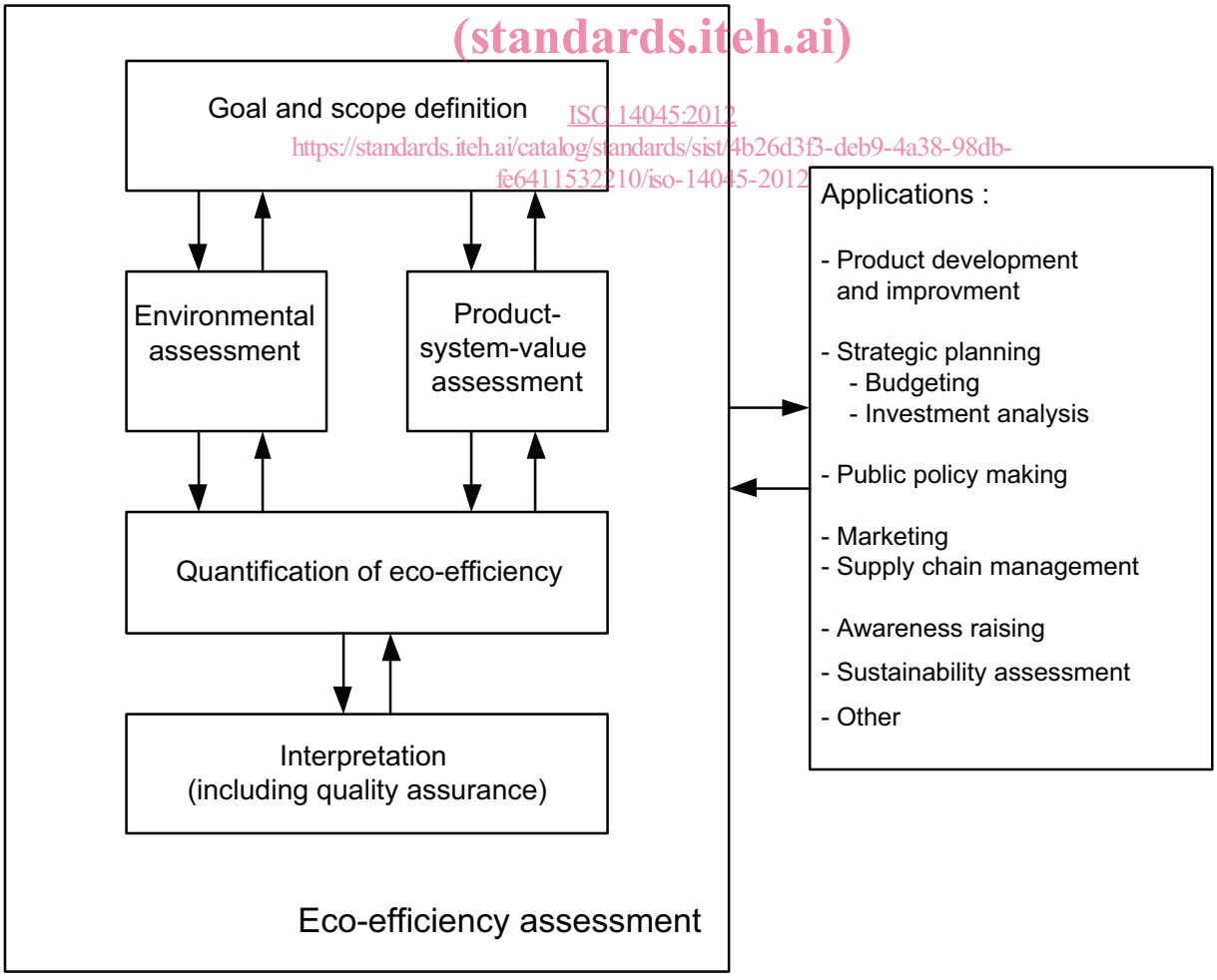

Figure 1 — Phases of an eco-efficiency assessment

4.3 Key features of an eco-efficiency assessment

An eco-efficiency assessment is an assessment of the environmental performance of a product system in relation to its value.

Eco-efficiency is a practical tool for managing environmental and value aspects in parallel.

The result of the eco-efficiency assessment relates to the product system, not the product per se. A product cannot be eco-efficient, only its product system which includes the production, use, disposal, i.e. the full life cycle, can be. Also, eco-efficiency is a relative concept and a product system is only more-or-less eco-efficient in relation to another product system.

5 Methodological framework

5.1 General requirements

Eco-efficiency assessments shall include goal and scope definition, environmental assessment, product system value assessment, quantifications of eco-efficiency and interpretation.

5.2 Goal and scope definition (including system boundaries, interpretation and limitations)

5.2.1 Overview of requirements

5.2.1.1 In defining the goal, the following items shall be considered and clearly described:

— the purpose of the eco-efficiency assessment;

— the intended audience;

— the intended use of the results.

5.2.1.2 In defining the scope, the following items shall be considered and clearly described:

— the product system to be assessed;

— the function and functional unit;

— the system boundary of the product system;

— the allocations to external systems;

— the environmental assessment method and types of impacts;

— the value assessment method and type of product system value;

— the choice of eco-efficiency indicator(s);

— the interpretation to be used;

— the limitations;

— the reporting and disclosure of results.

5.2.2 The product system to be assessed

The product system shall be defined by its name and the scale, location, time and main stakeholders which are involved.

5.2.3 Function and functional unit

The scope of an eco-efficiency assessment shall clearly specify the functions (performance characteristics) of the product system being studied. A functional unit shall be defined that is consistent with the goal and scope of the eco-efficiency assessment.

One of the primary purposes of a functional unit is to provide a reference for the environmental assessment and for the product system value assessment. Therefore, the functional unit shall be measurable and clearly defined.

5.2.4 System boundary

The system boundary shall be described as specified in ISO 14044.

The system boundary shall be the same for the environmental and the product system value assessment.

5.2.5 Allocations to external systems

Allocations to adjacent systems outside the system boundary shall be identified and allocation principles used shall be described.

5.2.6 Environmental assessment method and types of impacts

It shall be determined which elementary flows, cut-off criteria, allocation rules, impact categories, category indicators, characterization models and weighting methods will represent the environmental aspect in the eco-efficiency assessment. The selection of elementary flows, cut-off criteria, allocation rules, impact categories, category indicators, characterization models and weighting methods shall be consistent with the goal of the study.

Exclusions made for the purpose of the eco-efficiency assessment shall be described and justified.

5.2.7 The product system value

Different stakeholders may encounter different values for the same product system. For instance, the product system value to the consumer may be different from the product system value to the producer, and in turn different from the product system value to the investor.

It shall be described which stakeholder's value(s), type of value(s) and methods used to determine the product system value(s) are to be used in the assessment. The value(s) shall be quantifiable with reference to the functional unit according to the goal and scope of the eco-efficiency assessment.

NOTE The types of product system values can be as follows:

— functional value;

— monetary value;

— other values.

5.2.8 Choice of eco-efficiency indicator(s)

There are several types of eco-efficiency indicators that may be chosen to express a quantitative statement on eco-efficiency.

The eco-efficiency indicator(s) to be used in the assessment shall be described. The evaluation method(s) and the presentation format of the eco-efficiency assessment shall be defined.

For the choice of eco-efficiency indicators, the following requirements apply:

— increasing efficiency at the same product system value shall represent an improved environment;

— increasing efficiency at the same environmental impact shall represent an improved product system value.

5.2.9 Interpretation to be used

The need for the following aspects of interpretation shall be clearly defined:

— an identification of the significant issues based on the results of the environmental and product system value assessment phases;

— an evaluation that considers aspects of completeness, sensitivity, uncertainty and consistency;

— the formulation of conclusions, limitations and recommendations;

— a comparison of eco-efficiency assessment results.

5.2.10 Limitations

The scope in itself defines the conditions under which the assessment is made. In principle, the results are not valid outside the scope.

Choices made to define the scope for the eco-efficiency assessment implicitly also define and limit the applicability of the results from the assessment.

To prevent misuse of the results, the specific applications for which the results are not intended to be used may be identified.

5.2.11 Reporting and disclosure of results

The type and format of the report and the means of disclosure shall be defined.

5.3 Environmental assessment

5.3.1 General

Environmental assessment shall be based on life cycle assessment according to ISO 14040 and ISO 14044.

5.3.2 Life cycle inventory (LCI) results

The result of an LCI study may be used directly as input to an eco-efficiency assessment. For instance, where resource use and emissions predominantly originate from the use of fossil oil, the crude oil flow may be used as the sole environmental input.

5.3.3 Life cycle impact assessment

5.3.3.1 General

Life cycle impact assessment (LCIA), if it is done, shall be in accordance with ISO 14040 and ISO 14044.

5.3.3.2 Impact category indicator results

Life cycle impact category indicator results, as determined according to ISO 14044, may be used for eco-efficiency assessments. Such data will typically result in an eco-efficiency profile, where several environmental aspects are considered in parallel.

5.3.3.3 Weighting

Weighting shall not be used in eco-efficiency assessments for comparative eco-efficiency assertions intended to be disclosed to the public.