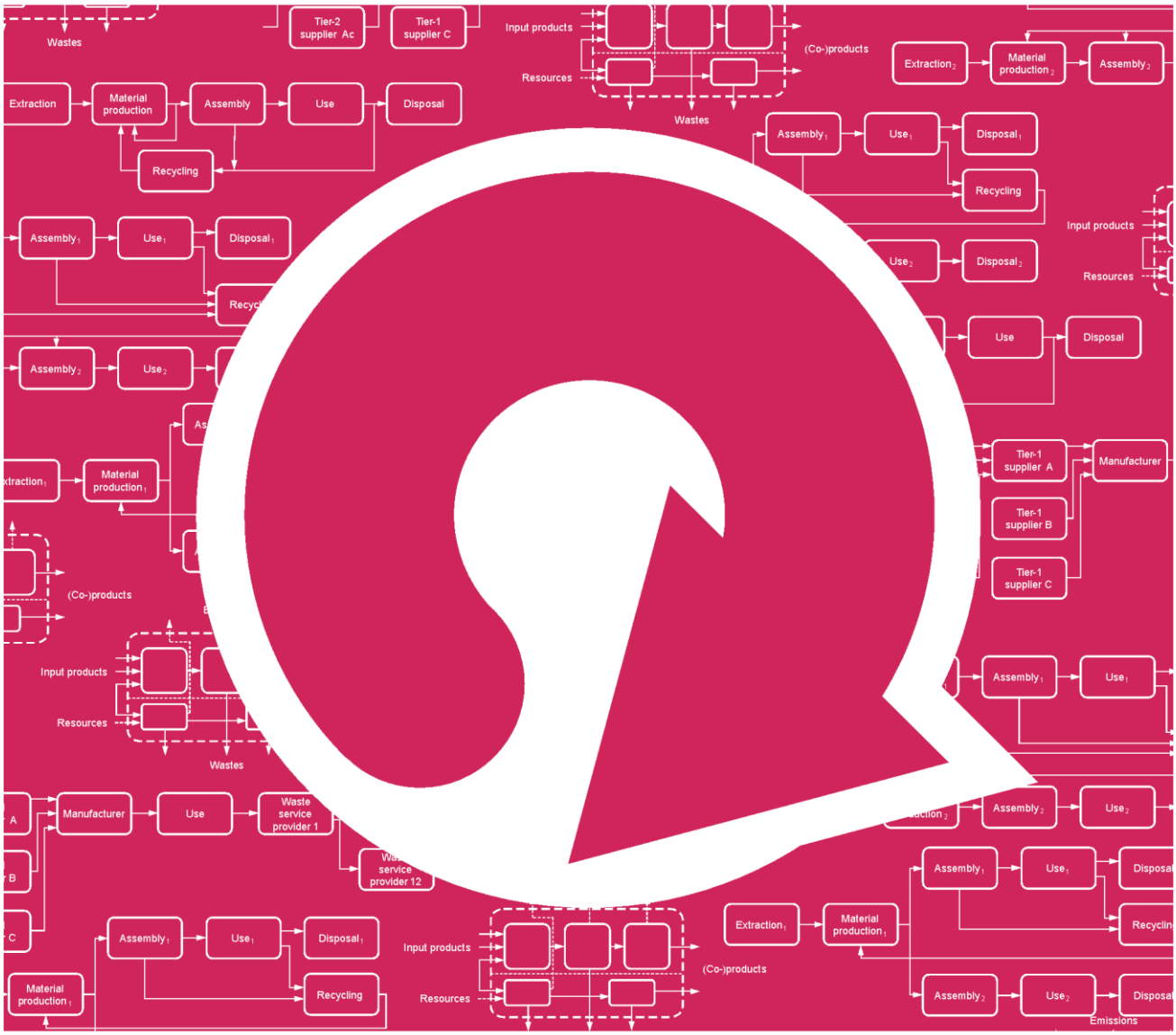
ILCD handbook

International Reference Life Cycle Data System



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Review schemes for Life Cycle Assessment

First edition

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Preface

To achieve more sustainable production and consumption patterns, we must consider the environmental implications of the whole supply-chain of products, both goods and services, their use, and waste management, i.e. their entire life cycle from “cradle to grave”.

In the Communication on Integrated Product Policy (IPP), the European Commission committed to produce a handbook on best practice in Life Cycle Assessment (LCA). The Sustainable Consumption and Production Action Plan (SCP) confirmed that “*(…) consistent and reliable data and methods are required to asses the overall environmental performance of products (…)*”. The International Reference Life Cycle Data System (ILCD) Handbook provides governments and businesses with a basis for assuring quality and consistency of life cycle data, methods and assessments.

This document provides the detailed provisions on the review types required for various life cycle data and studies in the form of ‘review schemes’. The principle target audience for this guide is the LCA reviewer and practitioner, as well as technical experts in the public and private sector dealing with environmental decision support related to products, resources, and waste management.

Executive summary

Overview

Life Cycle Thinking (LCT) and Life Cycle Assessment (LCA) are the scientific approaches behind modern environmental policies and business decision support related to Sustainable Consumption and Production (SCP).

The International Reference Life Cycle Data System (ILCD) provides a common basis for consistent, robust and quality-assured life cycle data and studies. Such data and studies support coherent SCP instruments, such as Ecolabelling, Ecodesign, Carbon footprinting, and Green Public and Private Procurement.

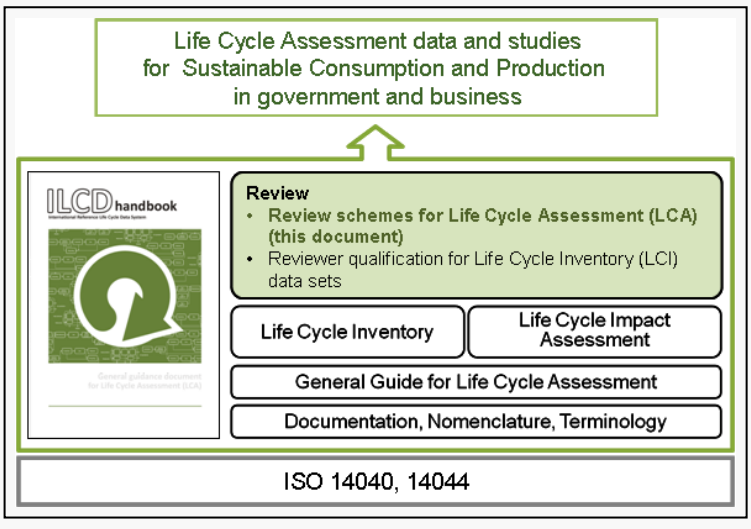
This guide is a component of the International Reference Life Cycle Data System (ILCD) Handbook (see figure). It provides the detailed provisions on the review types required for various life cycle data and studies, as well as direct applications in the form of 'review schemes'.

The principle target audience for this guide is the LCA reviewer and practitioner, as well as technical experts in the public and private sector dealing with environmental decision support related to products, resources, and waste management.

About the International Reference Life Cycle Data System (ILCD)

The International Reference Life Cycle Data System (ILCD) consists primarily of the ILCD Handbook and the ILCD Data Network. The ILCD Handbook is a series of technical documents providing guidance for good practice in Life Cycle Assessment for business and government. The ILCD Handbook also serves as a "parent" document for ILCD-compliant sector and product-specific guidance documents, criteria and simplified tools.

Role of this document within the ILCD Handbook



This document defines, through a set of review schemes, the minimum required types of review for life cycle assessment data, studies, some direct applications, and ILCD-based product-group specific guidance documents. Quality and consistency are essential in public policy and business context. This can be largely assured through 'critical review' of the underlying data and of the Life Cycle Assessment studies themselves. A review assesses whether a Life Cycle Assessment study or related data set has met pre-defined requirements. Undertaking a review can help avoid errors, ensure that all options or method requirements have been appropriately taken into account, as well as increase stakeholder confidence and buy-in into results. Failing to perform a review can cost significantly more in the long term than you initially save.

The principle requirements for reviews are very briefly addressed in the ISO 14040 series. While other LCA-based standards define some review requirements in more detail, none of them provides information on how to conduct the reviews, or the required qualifications of reviewers. Therefore, more specific requirements and guidance on reviewing Life Cycle Inventory and Life Cycle Assessment studies are given in the ILCD Handbook. The ILCD review requirements conform to the LCA-based ISO standards.

Review requirements addressed in this document

Distinctions are made for the necessary level of review in different application contexts through a set of review schemes for 12 cases. Differentiation is made with respect to the intended audience of the studies (external, technical, and non-technical audiences), complexity and broadness of the assessment, and the necessary type of stakeholder involvement (depending e.g. whether product comparisons are included in a study). This includes identification of the corresponding review-related activities, roles and responsibilities. The overall objective is to assist quality-assurance of life cycle data, studies and to enable the provision of reliable decision support in business and government. These review schemes balance costs of reviews with the need for such independent assurances.

Two review types, ‘independent external review’ and ‘independent panel review’ are defined that are applicable to the 12 cases. Organisations can request more stringent requirements at their discretion.

The review schemes of this document can be operated by, for example, national bodies or private organisations.

For all types of review, the independence, qualification and experience of the reviewer(s) is absolutely necessary. The four main aspects of qualification and experience are expertise in Life Cycle Assessment methodology, knowledge of the applicable review rules, review or verification experience, and technical expertise on the process or product that has been analysed in the study that is to be reviewed. The procedure for verifying that a reviewer has the appropriate qualification is outlined in the separate document "Reviewer qualification".

These two review documents are complemented by a separate guidance document “Review scope, methods and documentation for Life Cycle Assessment (LCA)” that provides the details on the review process and its documentation.

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1 Definitions

1.1 Definitions specifically related to this document

Applicant: The body that submits the LCA case for review; typically the commissioner or developer of the LCA work, or user of LCA work carried out by others that is to be reviewed.

Business to Business (B2B): describes commerce transactions between businesses, such as between a manufacturer and a wholesaler, or between a wholesaler and a retailer**.**

Business to Consumer (B2C): The communication between business and an individual member of the general public purchasing or using goods, property or services for private purposes.

Comparison: An LCA study comparing alternative systems (e.g. products) that perform a similar or different function, but without explicitly stating superiority of or equality to any of the alternative systems.

Comparative assertion: An environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function [ISO 14040:2006, ISO 14025:2006].

Consumer: An individual member of the general public purchasing or using goods, property or services for private purposes [ISO 14025:2006].

Critical Review: Process intended to ensure consistency between an LCA and the principles and requirements of the international ISO 14040 series standards on LCA and/or other references (e.g. ILCD Handbook). It can be carried out by an expert (internal or external) or a panel of interested parties, depending on the requirements. [Adapted from ISO 14040:2006].

Data set (LCI or LCIA results data set): A document or file with life cycle information for a specific product or other reference (e.g. site, process, etc.), covering descriptive metadata as well as the quantitative life cycle inventory and/or life cycle impact assessment results data.

Disclosed to the public: Where the audience includes the general public, being non-technical and 'external', i.e. the study is publicly accessible[1]

Independent external reviewer: This is the reviewer, recognised by the system operator. They are not involved in the definition or development of the reviewed case and are therefore independent. This includes both the reviewer as a person and their employer as an organization. They are external, and are not part of or have no relevant relations for at least one year to any organization that performed, commissioned, financed or otherwise had relevant influence on the study to be reviewed (i.e. is external). The phrase "relevant relations" includes financial, legal or similar ties that would result in a conflict of interest such as subsidies, joint-venture partners, development partners, sales partners, or any other strategic cooperation partners.

Independent internal reviewer: A Reviewer recognised by the system operator, who is not involved in the study to be reviewed, or quantitatively relevant parts (e.g. background data) but can be part of the organization that performed or commissioned the LCA work.

[1] Note that this includes, for example, websites and scientific journals. The peer review process of journal papers is a separate issue that is not addressed here, while the underlying LCA study is.

Independent review panel: A panel of independent external reviewers with at least two members in addition to the panel chair. Each of them has to guarantee an independent review of the study.

Independent external review: A critical review carried out by an independent external reviewer. In case a single reviewer does not fulfill the skill requirements within the review case, more than one reviewer is required ("review team") to meet the required qualification.

Intended audience: Audience to whom the results of the study are intended to be communicated [Adapted from ISO 14044:2006].

Interested party: Individual or group concerned with or affected by the environmental performance of a product system, or by the results of the life cycle assessment [ISO 14044:2006].

LCA Case: One of the types of LCA work that are differentiated within this review frame and scheme.

LCA review: A process intended to ensure consistency between an LCI or LCA work and the principles and requirements of an LCA scheme. In the context of the ILCD, this LCA scheme is the ILCD Handbook and the underlying ISO 14040 and 14044 standards.

LCA scheme owner: See 'system operator '(below).

LCA Verification: See 'LCA review' (above).

Non-technical audience: Audience that has no real knowledge or distinct skills in LCA methodology.

Pre-reviewed information: Life Cycle Inventory (LCI) or Life Cycle Impact Assessment (LCIA) data sets or other information that is used in LCA work and has already been reviewed under this scheme.

Pre-verified information: See 'Pre-reviewed information' (above).

Review: See 'critical review' (above).

Review frame: Concept defining the general review needs and types, types of actors, principal roles and responsibilities, scope, methods, reporting, and reviewer qualification aspects to be addressed.

Review scheme: Specific provisions for review of an LCA work, defining the respective requirements on review type and reviewer qualification and independence.

Stakeholder panel: A group of interested parties involved in the review following an open invitation. Their opinion is to be considered in the review and if requested be included in the final review report. These interested parties can include such bodies and individuals as government agencies, non-governmental groups, competitors and affected industries. The confidentiality concerns of the applicant are to be met, without unduly compromising the value of the involvement of the interested parties.

System operator: An organization that defines, develops or adopts the rules, both structural and procedural. The system operators typically also recognize reviewers, whether of a private scheme such as the EPD program operator, or of a public scheme such as an governmentally recognized national/regional organization responsible for the national/regional application.

Technical audience: An audience with proven skills in LCA methodology.

Third party: A person or body that is recognized as being independent of the parties involved, as concerns the issues in question [ISO 14025:2006]. For example an interested party, other than the commissioner or the practitioner of the study. [ISO 14044:2006].

1.2 Other definitions

Accreditation Body: An organisation that acts as an accreditation party in the review scheme, which recognizes that the review qualifications and review management are in line with the review rules (established by the system operator). Its responsibility is to assure the qualification, capability and independency of the reviewer. [Adapted from ISO 9001].

Accreditation Party: Represents the independent body for the accreditation of the third party. Its responsibility is to ensure the qualification, capability and independency of the third party.

Accredited third party review: Where the critical review is carried out by an accredited independent external reviewer[2].

Background system: Part of the life cycle of a system (e.g. product system) on which the operator of the analysed process, product or other system has no direct information access, control or decisive influence. For example, this typically covers most of the upstream/supply-chain processes, and generally all processes further downstream not under direct contractual or other control or influence of the process operator.

Carbon footprint / label / declaration: Private and public schemes that calculate and/or communicate information related to the contribution to climate change that is related to a product or other reference (e.g. site, company, activity).

Eco-design: An approach to design of a product with special consideration for the environmental impacts of the product throughout its whole lifecycle.

Environmental Label or Environmental declaration: A claim which indicates the environmental aspects of a product or service. An environmental label or declaration may take the form of a statement, symbol or graphic, found for example on a product or package label, in product literature, in technical bulletins, or in advertising or publicity. [Adapted from ISO 14020:2000].

Environmental Label and Declarations - Type I Environmental Labelling (Ecolabel): A voluntary, multiple-criteria-based third party programme that awards a licence, authorizing the use of environmental labels on products. These labels indicate overall environmental desirability of a product within a particular product category based on life cycle considerations. [ISO 14024:1999] Examples include the Japanese EcoMark, the European Union EU Flower, the Scandinavian Swan, the German Blue Angel, and the Thai Green Label.

Environmental Label and Declarations - Type III environmental declarations: The Type III declaration (e.g. Environmental Product Declaration, EPD) reports the environmental performance of specific products over their entire life cycle or defined parts thereof. It is standardised in ISO 14025 and has initiated various private schemes, e.g. the International EPD System (consortium in Sweden), EcoLeaf (by JEMAI in Japan), the AUB scheme (building industry in Germany) etc.

Environmental Management Systems (EMS) Designed for sites and companies etc, the EMS is a structured approach which sets out environmental targets and methods that enable these targets to be achieved. EMS was standardised as ISO 14001 with national and regional schemes, such as the Environmental Management and Auditing Scheme (EMAS) of the European Commission.

[2] An accredited third party review is not used in the ILCD review schemes. Please note however, that accreditation may be an additional requirement imposed by the specific application scheme that is supported by the to-be-reviewed LCA work.

Environmental Product Declaration (EPD): see 'Environmental Label and declarations - Type III environmental declarations' (above).

Foreground system: Part of the life cycle of a system (product or other reference) around which the life cycle model is built and to which the study relates. This is where the process or product operator has direct information access and control, for example the producer's site and other processes operated by their company or contractors (e.g. goods transport, head-office services, etc).

Key Environmental Performance Indicator (KEPI): A set of technical and management parameters of a system (e.g. a product or process) over its life cycle that quantitatively represent the system's environmental life cycle performance. It is identified with the help of detailed LCAs of the product / product-group and is used in product (-group) specific Ecodesign.

Life Cycle Assessment (LCA): Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a system (e.g. product) throughout its life cycle. [Adapted from ISO 14044:2006].

LCA application: The use of LCA information in instruments for decision support, monitoring, reporting, communication etc. Examples are Ecodesign, identifying criteria for Type I Ecolabels, LCA-based product comparisons, monitoring development of environmental performance of products / product groups / nations, addressing indirect effects in environmental management schemes, communicating product life cycle performance with EPDs/Type II Ecolabels, etc.

LCA work: Any activity that applies LCA methodology, resulting in an LCI data set, an LCIA model, method or characterisation factor, or an LCA study of any kind.

Life Cycle Impact Assessment (LCIA): Phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product. [ISO 14044:2006]

Life Cycle Inventory analysis (LCI): Phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a given system (e.g. product) throughout its life cycle. [adapted from ISO 14044:2006] It results in LCI data for the system, such as single operations/processes, whole systems, etc, over the life cycle.

Product category rules (PCR): set of specific rules, requirements and guidelines for developing Type III environmental declarations for one or more product categories [ISO 14025:2006].

2 Introduction and overview

The global market place is increasingly demanding science-based, verified and comparable information regarding the environmental performance of products and services. Life Cycle Assessment (LCA) is widely recognised as the most advanced approach for obtaining such information on a quantitative, comparable basis. LCA is internationally standardized in the ISO 14040 series.

Critical review of LCA is addressed in the ISO 14040 series in a broad manner, giving a framework for conducting such a review. Other LCA-based standards define some review aspects (ISO 14025 on Type III environmental declarations). Details on reviewer qualifications and review procedures however are not provided. This means that the relevant ISO 14020ff and 14040ff standards alone do not provide practical guidance for reviewing Life Cycle Inventory data (LCI, emissions and resource consumption), data for environmental Impact Assessment for LCA (LCIA) nor overall LCA studies and associated applications. Therefore detailed and specific guidance for reviewing LCA work is required.

A review framework and coherent review schemes are expected to considerably increase validity and comparability of reviews, lower the efforts and costs for review, and support higher trustworthiness and acceptance of LCA. This is a pre-requisite for the regular use of LCA in stakeholder and public policy contexts.

The **International Reference Life Cycle Data System (ILCD)** provides, through the ILCD Handbook, a series of guidance documents as a basis for consistent and quality-assured life cycle data and assessments. This is supported by the LCI data sets in the ILCD Data Network, for which the ILCD Handbook is also the basis. (See separate document “ILCD introduction and overview” for further details).

The **purpose and scope of this Guidance Document** is to define different review types for LCA work under different general goal situations (“cases”) for external audiences, as follows:

Life Cycle Inventory (LCI) data sets:

- Micro level LCI data sets

LCIA Models, Methods and Characterization factors:

- LCIA models
- LCIA factors

Direct LCA Applications:

- Comparative assertion at micro-level (e.g. products) disclosed to the public;
- Meso/macro level LCA studies for technical audience;
- Meso/macro level LCA studies and Meso/Macro Life Cycle based Monitoring Indicators;
- LCA studies for identifying Type I Ecolabel criteria and Eco-design key environmental performance indicators (KEPI);
- Indirect aspects in Environmental Management Schemes (EMS);
- Micro level LCA studies and Micro level LCA-based Monitoring Indicators;
- Environmental Product Declarations (EPD) for both Business to Business (B2B) and Business to Consumer (B2C).
- Product Category Rules (PCR) for type III, product-group and sector-specific guides.

This document provides the classification of review types, identification of suitable types of review for each of the cases, and description of review schemes for each of the cases.

3 Review type for each type of LCA work

3.1 Relevant International Standards and guidance document

For the aforementioned cases the recognized standards and relevant guidance documents for the review schemes are:

a) ISO Standards:

- ISO 14001: 2004 Environmental Management Systems -Requirements and guidance for use.
- ISO 14004: 2004 Environmental Management Systems - General guidelines on principles, systems and support techniques.
- ISO 14020: 2000 Environmental Labels and Declarations - General principles.
- ISO 14024: 1999 Environmental Labels and Declarations - Type I environmental labelling — Principles and procedures Environmental labels and declarations.
- ISO 14025: 2006 Environmental Labels and Declarations -- Type III environmental declarations -- Principles and procedures.
- ISO 14040: 2006 and ISO 14044: 2006 Environmental Management – Life Cycle Assessment.
- ISO/TR 14062: 2002 - Environmental Management - Integrating environmental aspects into product design and development.

b) ILCD Handbook

3.2 Type of LCA considered for review scheme

The most suitable review scheme that provides the required minimum guarantee of quality assurance at minimum cost is dependent on the goal of the LCA work(s). This depends on the goal definition, particularly:

- The intended application and decision context.
- The reasons for carrying out the study.
- The intended audience; to whom the results of the study are intended to be communicated both internally and/or externally.

In addition, two types of intended audience can be characterized according to their technical knowledge:

- Technical, if skills in LCA methodology are held.
- Non-technical, if no or limited skills in LCA methodology are held.

In addition and especially relevant for a non-technical audience, is that it is to be differentiated whether the results are intended to be used for comparisons, or comparative assertions intended to be disclosed to the public. As a basis for the review types, Table 1 provides a summary in relation to the external[3] intended audiences and potential public disclosure.

[3] Note that the review schemes relate exclusively to an external audience. They may however serve as suggestion for internal use, if appropriate.

Table 1 Cases and their intended audience

SITUATIONS ANALYSED	DECISION CONTEXT / ILCD Goal Situation[4]	CHARACTERISTIC OF EXTERNAL INTENDED AUDIENCE	"DISCLOSED TO THE PUBLIC"	
			YES	NO
Micro level LCI data sets	A, B, or C[5]	Technical	X	
LCIA model	-	Technical	X	
LCIA factors	-	Technical	X	
Comparative assertions on micro-level (e.g. products) disclosed to the public	A	Non-technical	X	
Meso/macro level decision support LCA studies and Meso/Macro Life Cycle based accounting indicators	B	Non-technical	X	
Meso/macro level LCA studies	B	Technical		X
LCA studies for identifying Type I Ecolabel criteria and Eco-design Key Environmental Performance Indicators (KEPIs)	A	Technical		X
Indirect aspects in Environmental Management Schemes (EMS)	C1	Non-technical	X	
Micro level LCA studies/ Micro level monitoring indicator	A	Technical		X
Environmental product declarations (EPD)	A	Non-technical	X	
Environmental product declarations (EPD) (B2B)	A	Non-technical		X
Product Category Rules (PCR) for type III, product-group and sector-specific guides	A	Technical	X	

[4] A) Decision support at micro level (e.g. for product-related questions)

B) Decision support at a meso or macro level, such as for strategies (e.g. raw materials strategies, technology scenarios, policy options, etc), with large-scale consequences outside the foreground system of the analysed system.

C) Purely descriptive monitoring / documentation of the analysed system (e.g. a product, need fulfilment, sector, country, etc) of the past, present or forecasted future and without accounting for any potential additional consequences on other systems. Existing consequences (e.g. avoided burden by recycling) are included in C1.

More detail of situations A, B and C is provided in the "ILCD Handbook - General guide on LCA".

[5] Depending on the specific goal situation to be supported by the data set.

A review typically involves various parties with different roles in relation to the development, operation, and review as well as (potentially) certification of the scheme. This includes the operator of the scheme (system operator), the applicant, the intended audience, the reviewer(s) and, if any, an accreditation body. However not all parties have to be involved in each specific review scheme. This depends on the individual case and the associated requirements.

These LCA review schemes are developed for applications addressed to external audiences and consider other factors which are provided in a later subchapter. Table 2 shows two types of review.

Table 2 Relationship between the type of review, number of independent reports, mechanisms within the schemes and the level of assurance

Type of review[6]	Number of reviewers	Number of Independent reports	Mechanism to control reviewers' independence	Levels of assurance
Independent external review	1 or more[7]	1	YES	1
Independent external panel review	3 or more	1 final report and 3 or more individual reports, if deviating	YES	2

Note: The definition of each review type is stated in the definition section

3.3 Considered types of review and parties involved

In order to link the LCA cases with the review schemes, the five criteria are:

- Extent of stakeholder involvement, or interests affected;
- The technical knowledge/experience of the audience;
- Complexity and broadness of the case
- Requirement by ISO standards
- The cost for the LCA review process has to be limited as much as possible, while respecting the case-specific need for quality assurance.

The types of review identified represent the minimum (mandatory) requirements. Table 3 suggests the most appropriate type of review for the intended audience of each case, but, if desired, an applicant can apply higher requirements.

The type of review that is applied has to be made clear to the audience in order to avoid a misleading communication.

In addition, for some cases, interested parties shall be openly invited to form a stakeholder panel. This applies to the review of "LCA studies for identifying Type I Ecolabel criteria and Eco-design 'Key Environmental Performance Indicators' (KEPIs)", "Future LCA

[6] There are five review types that are commonly known :1) Independent internal review, 2) Independent external review, 3) Accredited review, 4) Independent panel review 5) Independent accredited panel review.

[7] More than one, in case one reviewer alone cannot meet all requirements in terms of reviewer qualification ("review team").

studies (non-technical audience)", and "Product Category Rules (PCR) for type III, product-group and sector-specific guides ".

The 12 differentiated cases of LCA work are assigned to the different review types, as presented in Table 3.

Table 3 Minimum review requirements of each LCA work for ILCD system based on stakeholder involvement, and technical knowledge of the audience[8]

Knowledge of the audience		**Required involvement of interested parties**
Technical audience	**Non-technical audience**	
Independent external review • Micro level LCI data sets • Life Cycle Impact Assessment (LCIA) factors • Micro level LCA studies and Micro level LCA based monitoring indicator **Independent panel review** • LCIA models	**Independent external review** • Indirect aspects in Environmental Management Systems (EMS) • Environmental Product Declarations (EPD) for business-to-business (B2B)[9]	No
Independent panel review • Comparative assertions disclosed to the public • LCA studies for identifying Type I Ecolabel criteria and Eco-design "Key Environmental Performance Indicators" (KEPI) • Product Category Rules (PCR) for type III, product-group and sector-specific guides **Independent external review** • Meso/macro level LCA studies	**Independent external review** • Environmental Product Declarations (EPD) for business to consumer (B2C)[13] **Independent panel review** • Meso/macro level decision support LCA studies and Meso/macro Life Cycle based accounting indicator	Yes *(plus stakeholder panel)*

[8] There is no requirement for internal audience but we suggest conducting an independent internal review or independent external review using ILCD review document template.

[9] Includes product carbon footprint and declaration.

4 Review schemes

These LCA review schemes are developed for applications addressed to external audiences and also for public disclosure. The developed verification schemes may nevertheless also serve as suggestions for internal audience or voluntary work, as appropriate. This chapter provides a description of the different review schemes for each case.

The following aspects are taken into account:

- Organisational structure
  - Type of organization(s) to be involved
  - Identification of main actors
- Operational structure
  - Procedures and protocol needed
  - Composition of review team or panel
  - Qualifications of reviewer(s)
- Case
  - For example “LCA studies for Environmental Product Declarations (EPD) development”, or “LCA studies for identifying Type I Eco-label criteria”.

4.1 Organisational structure

The actors who are involved in the operation of the review are:

System Operator, Applicant, reviewer(s), stakeholder panel

(see “Definitions" chapter on page 8 for more info)

4.2 Operational structure

4.2.1 Procedures and protocols

The review scheme is based on the following procedures and protocols:

- **General standards/guidance:** The ILCD Handbook and underlying ISO 14040:2006 and 14044:2006 for LCA methodology, and other related standards and guidance for each LCA case (if any) as named in chapter 4. The general standard/guidance provides generic information including rules and requirements for LCA cases.
- **General rules:** Composed and updated in line with the General standards/guidance. Additionally, rules and requirements of the specific schemes have to be considered (if present) e.g. EPD system. This includes potentially stricter requirements such as those for reviewer qualification, accreditation and others.
- **Review procedures:** Common guidelines based on the ILCD Handbook and “Review schemes for Life Cycle Assessment (LCA)” in the document “Review scope, methods, documentation for Life Cycle Assessment (LCA)”.

4.2.2 General Reviewer requirements and skills

An eligible reviewer shall firstly meet the following requirements:

- Independency: Reviewer shall demonstrate his/her independency from both organization and LCA study (*for further details see definition of independent external reviewer, page 9*). Proof should be requested by the System Operator or Applicant.
- Language: Reviewer shall have sufficient language skills; the Applicant shall identify the required language(s) and the minimum degree of language skill.
- LCA methodology: as given in the general standards and guidance. For LCIA, the expertise of reviewers in the scientific disciplines relevant to the important impact categories of the study, in addition to other expertise and interest, shall be considered.
- Review and audit expertise and experience.
- System expertise: Environmental, technical, and other relevant performance aspects of the system(s) represented For example product(s), technologies, other activities, etc. Also, if applicable, performance aspects of the included relevant processes, unless these have already been reviewed under this review scheme ("pre-reviewed information").

In case a particular reviewer does not fulfil all the skill requirements, more than one reviewer can form a review team to fulfil the overall requirements necessary for the review.

Table 4 lists the additionally required specific skills of the reviewer, for each case.

Table 4 Overview of the review schemes for each LCA case (the workflow for each LCA case is presented in a later subchapter)

CASE	Additional Reviewer(s) skills, besides general skills
Micro level LCI data sets	Technical and market aspects of the industrial sector to which the LCI data set refers.
LCIA models	Environmental modelling; fate and damage modelling.
LCIA factors	Environmental modelling; fate and damage modelling, particularly different effects from different geographies.
Comparisons and comparative assertions	Technical and market aspects of the industrial sector to which the LCA refers.
Meso/macro level LCA studies and indicators (non technical audience)	Scenario formation, technology forecasting, equilibrium modelling if applicable. Technical and market aspects of the industrial sector to which the LCA refers.
Meso/macro level LCA studies (technical audience)	Scenario formation, technology forecasting, equilibrium modelling if applicable. Technical and market aspects of the industrial sector to which the LCA refers.
LCA studies for identifying type I Ecolabel criteria and Eco-design “Key Environmental Performance Indicators”	Technical and market aspects of the industrial sector to which the LCA refers.
Calculation of indirect aspects in EMS	ISO 19011 – 19012 standards. Experience and competence in LCA-related issues.
LCA studies for Environmental Product Declarations (EPD) development	Environmental management related to industrial processes. Technical and market aspects of the industrial sector to which the LCA refers.
Environmental Product Declarations (EPD)	For further details see ISO 14025.
Product Category Rules (PCR) for type III, product-group and sector-specific guides	For further details see ISO 14025. Also technical and market aspects of the industrial sector to which the PCR refers.

4.2.3 Work flow of each review type

An overview of the workflow for each review type is shown in figures 2, 3 and 4 focusing only on the review process. The different type and process of review depends on the factors mentioned in previous chapters.

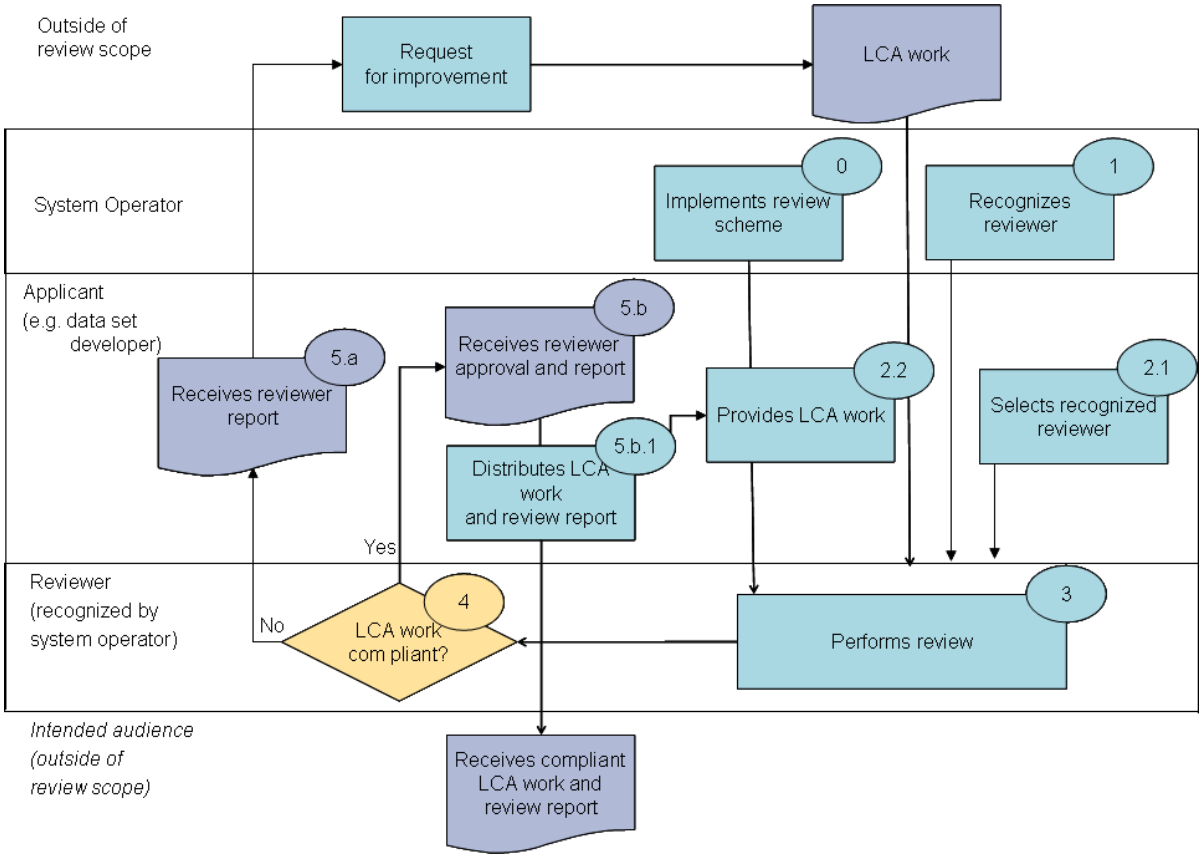

Figure 1 **Independent External Review: for Micro level LCI data sets, LCIA factors, Calculation of indirect aspects in EMS, Micro level LCA studies, Micro level LCA based monitoring indicator, and type III declaration / Environmental Product Declarations (EPD) (business-to-business communication).**

Legend:

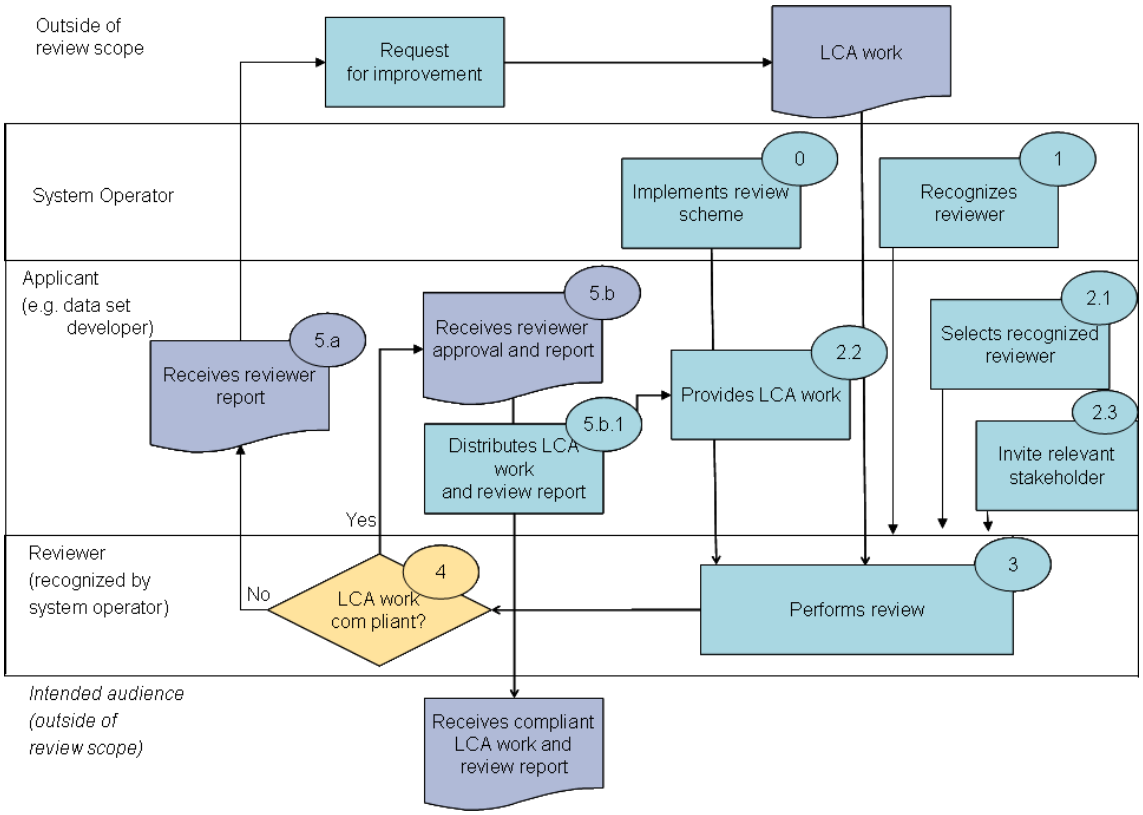

Figure 2 **Independent external review: for type III declarations / Environmental Product Declarations (EPD) (for business-to-consumer communication) and meso/macro level LCA studies (for technical audience).**

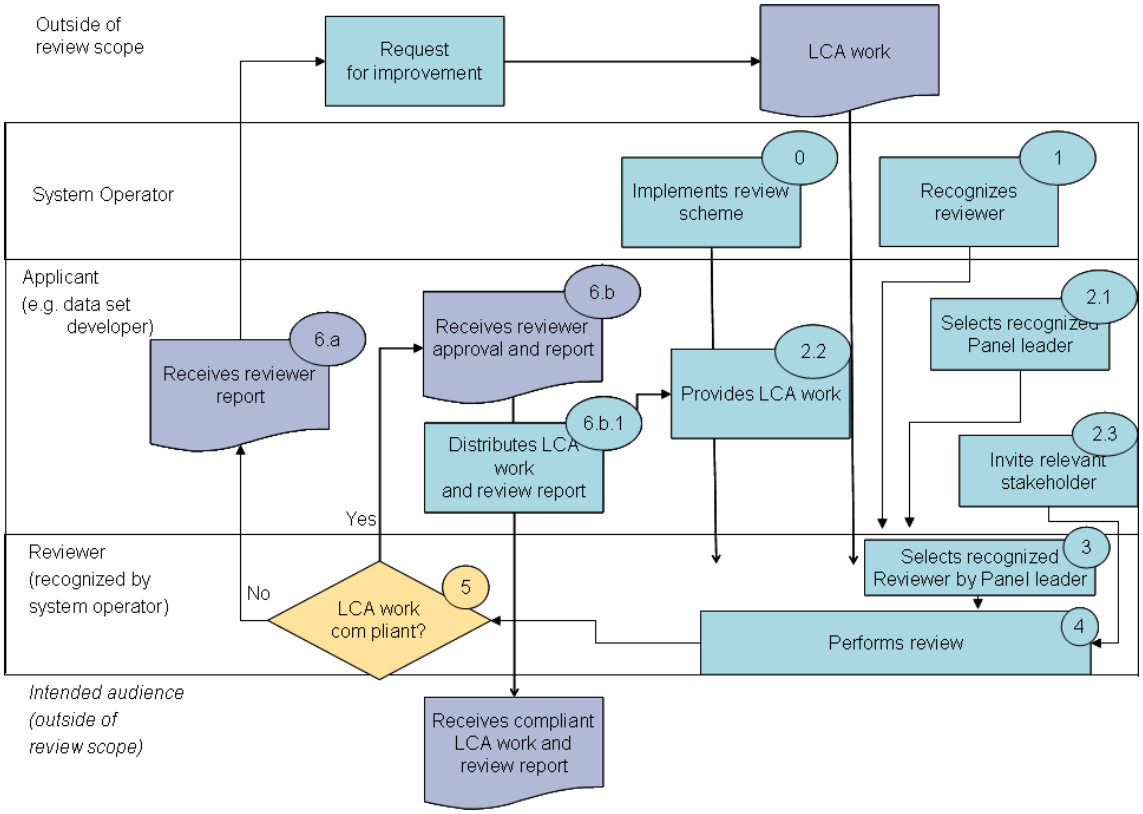

Figure 3 **Independent external panel review: for Comparative assertions disclosed to public, LCA studies for identifying type I ecolabel criteria and eco-design KEPI, LCIA models, product category rules (PCR), and meso/macro level decision support LCA studies and accounting indicators (non/technical audience).**

5 Annex A: Development of this document

Development of this document

Based on and considering the following documents

This document has been developed starting from and further differentiating and specifying the provisions of the ISO standards 14024, 14025, 14040, and 14044. A large number of LCA manuals of business associations, national LCA projects, consultants and research groups, as well as scientific LCA publications have been analysed and taken into account (for further details see Explanatory Memorandum).

Drafting

This document was drafted with support under JRC contract 383558 “Technical guidance for review in LCA, embedded into an accredited certification scheme”.

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External expert meeting

The external experts have discussed earlier drafts of this document with the contractors and the JRC staff, during two dedicated one-day workshops.

Invited stakeholder consultation

An earlier draft version of this document has been distributed to more than 60 organisations and groups. This includes the 27 EU Member States, various European Commission (EC) services, National Life Cycle Database Initiatives outside the European Union, Business Associations as members of the Business Advisory Group, Life Cycle Assessment Software and Database Developers and Life Cycle Impact Assessment Method Developers as members of the respective Advisory Groups, as well as other relevant institutions.

Public consultation

The public consultation was carried out on the advance draft guidance document from 10 June 2009 to 31 August 2009. This included a public consultation workshop which took place from June 29 - July 2, 2009 in Brussels.

Overview of involved or consulted organisations and individuals

The following organisations and individuals have been consulted or provided comments, inputs and feedback during the invited or public consultations in the development of this document:

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Invited consultation

Internal EU steering committee

- European Commission services (EC),
- European Environment Agency (EEA),
- European Committee for Standardization (CEN),

- European Topic Centre on Resource and Waste Management
- IPP representatives of the 27 EU Member States

National database projects and international organisations:

- United Nations Environment Programme, DTIE Department (UNEPDTIE)
- World Business Council for Sustainable Development (WBCSD)
- Brazilian Institute for Informatics in Science and Technology (IBICT)
- University of Brasilia (UnB)
- China National Institute for Standardization (CNIS)
- Sichuan University, Chengdu, China
- Japan Environmental Management Association for Industry (JEMAI)
- Research Center for Life Cycle Assessment (AIST), Japan
- SIRIM-Berhad, Malaysia
- National Metal and Material Technology Center (MTEC), Focus Center on Life Cycle Assessment and EcoProduct Development, Thailand

Advisory groups

Business advisory group

- Alliance for Beverage Cartons and the Environment (ACE), Europe
- Association of Plastics Manufacturers (PlasticsEurope)
- Confederation of European Waste-to-Energy plants (CEWEP)
- European Aluminium Association
- European Automobile Manufacturers' Association (ACEA)
- European Cement Association (CEMBUREAU)
- European Confederation of Iron and Steel Industries (EUROFER)
- European Copper Institute
- European Confederation of woodworking industries (CEI-Bois)
- European Federation of Corrugated Board Manufacturers (FEFCO)
- Industrial Minerals Association Europe (IMA Europe)
- Lead Development Association International (LDAI), global
- Sustainable Landfill Foundation (SLF), Europe
- The Voice of the European Gypsum Industry (EUROGYPSUM)
- Tiles and Bricks of Europe (TBE)
- Technical Association of the European Natural Gas Industry (Marcogaz)

LCA database and tool developers advisory group

- BRE Building Research Establishment Ltd - Watford (United Kingdom)
- CML Institute of Environmental Science, University of Leiden (The Netherlands)
- CODDE Conception, Developement Durable, Environnement – Paris (France)
- ecoinvent centre – (Switzerland)
- ENEA – Bologna (Italy)
- Forschungszentrum Karlsruhe GmbH - Eggenstein-Leopoldshafen (Germany)
- Green Delta TC GmbH – Berlin (Germany)
- Ifu Institut für Umweltinformatik GmbH – Hamburg (Germany)

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- IVL Swedish Environmental Research Institute – Stockholm (Sweden)
- KCL Oy Keskuslaboratorio-Centrallaboratorium Ab – Espoo (Finland)
- LBP, University Stuttgart (Germany)
- LCA Center Denmark c/o FORCE Technology – Lyngby (Denmark)
- LEGEP Software GmbH - Dachau (Germany)
- PE International GmbH – Leinfelden-Echterdingen (Germany)
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Abstract

Life Cycle Thinking (LCT) and Life Cycle Assessment (LCA) are the scientific approaches behind modern environmental policies and business decision support related to Sustainable Consumption and Production (SCP). The International Reference Life Cycle Data System (ILCD) provides a common basis for consistent, robust and quality-assured life cycle data and studies. Such data and studies support coherent SCP instruments, such as Ecolabelling, Ecodesign, Carbon footprinting, and Green Public and Private Procurement. This guide is a component of the International Reference Life Cycle Data System (ILCD) Handbook (see figure). It provides the detailed provisions on the review types required for various life cycle data and studies, as well as direct applications in the form of ‘review schemes’. The principle target audience for this guide is the LCA reviewer and practitioner, as well as technical experts in the public and private sector dealing with environmental decision support related to products, resources, and waste management.

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