

# The enhanced LCA Resources Directory: a tool aimed at improving Life Cycle Thinking practices

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Received: 27 April 2012 / Accepted: 19 June 2012 / Published online: 10 July 2012  
  Springer-Verlag 2012

## Abstract

**Purpose** To support life cycle-based EU policies, the European Commission created the “European Platform on Life Cycle Assessment (EPLCA).” The platform aims at providing coherent and quality-assured life cycle data, methods, and studies. The LCA Resources Directory (RD), one of the deliverables of the EPLCA, has so far consisted of lists of services, tools, databases, and providers. It has been decided to extend its scope to contain a section on LCA studies with metadata to characterize them. The research question addressed in this paper is “which structure and features should the RD have to store LCA studies so that it can efficiently support and promote robust Life Cycle Thinking practices?”

**Methods** Existing tools with similar aims and objectives have been identified and analyzed to identify current performances and missing functionalities. A literature review concerning LCA studies in scientific and technical literature has been carried out in order to define relevant and consistent patterns. Following this analysis, it has been decided to develop a collaborative platform and an original structure has been proposed for the new section. The structure has been tested with a few LCA studies.

**Results** A new collaborative web platform of the resources directory has been developed and launched online. Contributors are now able to characterize LCA studies according to

43 fields of metadata, distributed among seven categories: general, goal, scope, inventory, impact assessment, interpretation, and review and compliance. Some fields are mandatory, and the fill-in boxes are either enumeration list or free text. The platform also contains a search tool to identify relevant LCA studies with their metadata. The administrator of the directory performs a consistency check before entries are shared with others.

**Conclusions** The EPLCA now contains a new collaborative web platform where LCA studies can be characterized and stored. It has been possible to identify a list of criteria for which LCA studies should be characterized. These criteria form the structure of the platform. It is too early to assess the actual usefulness of this new platform; this will be possible only when the directory is populated by contributors. With this new section in the RD, the EPLCA expands its aim of promoting Life Cycle Thinking and robust practices.

**Keywords** Collaborative platform · Compliance · EPLCA · Impact category · LCA study · Resources directory · Review

## 1 Context: the European platform on Life Cycle Assessment

The European Commission (EC) and others recognize Life Cycle Assessment (LCA) as “the best framework for assessing the potential environmental impacts of products” (Communication from the Commission to the Council and the European Parliament 2003; Finnveden et al. 2009). The EC also identifies “the need to improve data availability and quality worldwide by international cooperating on LCA data and methods” (Communication from the Commission to the Council and the European Parliament 2003). The life cycle approach is an important component of recent EU policies, including the 2011 Communication on the “Resource-efficient

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Responsible editor: David Pennington

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Europe—Flagship initiative under the Europe 2020 Strategy” (Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions 2001).

To support these life cycle-based EU policies, the EC bundled activities under the “European Platform on Life Cycle Assessment (EPLCA)<sup>1</sup>” project in 2005. Since then, the Joint Research Centre (JRC) has been implementing the platform in close collaboration with DG Environment. The EPLCA aims at increasing and improving existing practices, knowledge, and scientific robustness in Life Cycle Thinking (LCT) (Pennington et al. 2007). To this end, the EPLCA focuses on providing coherent and quality-assured life cycle data, methods, and information.

## 2 Extended scope of the LCA Resources Directory

The LCA Resources Directory (RD) is one of the deliverables of the EPLCA, together with the European Reference Life Cycle Database,<sup>2</sup> the International Reference Life Cycle Data System (ILCD) (European Commission 2011), and the LCT Forum.<sup>3</sup> The RD, which has been online since 2006, contains structured and comprehensive information related to life cycle services provided (e.g., by consultants or research organizations), software tools (e.g., LCA and ecodesign tools), databases (e.g., Life Cycle Inventory (LCI) databases), and links to the corresponding developers/providers worldwide. It supports the development and the dissemination of practical and quality-assured LCA tools and data (Finnveden et al. 2009).

With the ultimate goal of further improving scientific robustness of LCT practices, the scope of the RD has been recently expanded to include a new LCA studies section. The new RD includes a collaborative web platform containing a directory of LCA studies of goods/services and Environmental Product Declarations (ISO 14025 type).

This new web platform contains metadata to characterize each study, concerning in particular goal and scope, inventory modeling, results, review, and compliance. Although very useful for all users of LCA results (e.g., policy makers, businesses), this information is currently either not available or fragmented in LCA studies. The new directory can also be consulted or contributed to by any LCA practitioner.

The new LCA Resources Directory,<sup>4</sup> online since July 2012, is divided into three sections:

- “User guidance”: This section includes a quick guide to facilitate best use by several types of users (environmental managers, product designers, purchasers, LCA professionals, or policy makers).
- “Providers”: This section contains a list of organizations that provide LCT and related services (consulting or research). The section is divided into three categories: databases, services (e.g., methods, training), and software tools. This section includes a search tool.
- “Studies”: This collaborative section contains a structured directory of LCA studies of goods and services and of Environmental Product Declarations (ISO 14025 type). Studies can be found using a dedicated search tool.

The purpose of this paper is to introduce the new section Studies of the RD, and to discuss its expected benefits.

## 3 New functionalities of the LCA Resources Directory

In addition to an extended scope, the enhanced RD also has a new and more convenient online interface. The new functionalities of the directory allow users to directly populate it online, via a web interface, and to browse LCA studies. The new section of the RD also differs from other repository-type tools existing on the Internet in that not only LCA studies but also metadata for each study are provided.

### 3.1 Populating the RD

Any user, after registration, can populate the LCA studies section of the RD by becoming a “contributor.” This contribution functionality will be extended to other sections of the RD in the future.

After registering, the contributor is able to insert metadata for the study using the template provided. This template is composed of 43 fields, structured into seven sections: general (6 fields), goal (8 fields), scope (18 fields), inventory (2 fields), impact assessment (at least 2 fields plus additional fields in results are presented in images), interpretation (3 fields), and review and compliance (4 fields). Two kinds of fields can be encountered: enumeration lists and free text boxes. The fields (and associated values in enumeration lists) have been defined based on the ISO 14040:2006 (ISO 14040 2006), the ISO 14044:2006 (ISO 14044 2006) standards, and the ILCD Handbook (European Commission 2011). Some fields of the template are mandatory in order to ensure quality of the entries (by ensuring compliance with all of the ISO 14044 provisions for the disclosure of LCA reports to the public). Table 1 summarizes all the sections and fields of the template to be filled in by the contributor. The ones marked with an asterisk are

<sup>1</sup> <http://lct.jrc.ec.europa.eu>

<sup>2</sup> <http://lct.jrc.ec.europa.eu/assessment/data>

<sup>3</sup> <http://lct.jrc.ec.europa.eu/lct-forum>

<sup>4</sup> <http://lca.jrc.ec.europa.eu/new-directory/directory.vm>

**Table 1** Summary of sections and fields included in the template

General	Goal	Scope	Inventory	Impact assessment	Interpretation	Review and compliance
Contributor	Title of study*	Year of study *	Comment related to the inventory *	General results (attached image (s))	Limitations	Review type *
Contact address	Intended application (s)*	Type of analyzed object *	Inventory Document (attached document)	Impact category specific results (attached image (s))	Conclusions *	Separate review report *
Contact email	Reasons for carrying out the LCI/LCA study and decision context	NACE code of analyzed system (class) *			Recommendations	Compliance *
Type of study	Hypotheses *	Functions (performance characteristics) of the system(s) being studied *				Reference (how can I access this study?) *
Executive summary	Target audience *	Functional unit/declared unit *				
Full report* (attached document)	Comparative assertions to be disclosed to the public *	LCI modeling *				
	Commissioner of the LCI/LCA study *	Description of the systems being studied *				
	Authors / Full citation *	System boundaries * (attached image) System boundaries (diagram) Excluded life cycle stages and units process Geographical reference * Completeness requirements Cutoff rules * LCIA impact categories * Includes normalization * Includes weighting * Data quality requirements address the following issues * Assumptions				

\* mandatory fields

mandatory. For example, in the first section (“General”), the contributor defines the type of study to be added by choosing the most appropriate option from the following enumeration list: “LCA,” “Environmental Product Declaration,” or “LCA supporting Environmental Product Declaration.”

In the “Goal” section, the contributor must choose from among a list of 24 intended applications, including “Identification of key environmental performance indicators,” “Weak point analysis of a specific product,” “Comparison

of specific goods or services,” etc. If the user wants to upload and characterize an LCA-type study used for ecodesign of goods/services (e.g., a preparatory study of the EU Ecodesign Directive), for example, he/she can select the intended application “Ecodesign study.” If the user wishes to upload and document an LCA-type study used for ecolabelling purpose, the intended application “Development of life cycle-based Type I Ecolabel criteria” should be selected. Where none of the options matches the objective of the

study, the contributor can choose the “Others” option and describe the adequate application in the free text box. Non-compulsory fields of this section include “Reasons for carrying out the LCI/LCA study” and “decision-context.”

Similarly, the “Scope” section provides an enumeration list of possible LCI modeling approaches applied in the study, including five predefined types of modeling (attributional, consequential and LCI modeling according to ILCD Handbook Situation A, B, C1 and C2), and an “Other” free text option for specifying other types of modeling. The relevant life cycle impact categories can also be chosen from among a list of 15 typical categories, e.g., climate change, ozone depletion, human toxicity, particulate matter, ionizing radiation, photochemical ozone formation, acidification, eutrophication, ecotoxicity, land use, water depletion, and resource depletion. A free text box for specification of other categories is also provided. Noncompulsory fields for this section include “Excluded Life Cycle phases and units processes.” Results of the impact assessment can be added when uploading figures.

The template also prompts the contributor to provide information on the review process and on the compliance scheme used in the study. Table 2 illustrates the fields to be completed in the “Review and Compliance” section.

The study itself can be uploaded only once all mandatory information has been provided. Once the metadata have been entered and the study uploaded, the JRC checks the LCA relevance of the metadata before posting the new entry online. The new entry (including the reliability and the accuracy of the metadata) remains, however, the sole responsibility of the contributor.

### 3.2 Browsing the RD

The new section Studies includes a dedicated search tool to help users identify LCA studies that are relevant to their needs. This tool identifies relevant LCA studies based on keywords entered by the contributor in the metadata fields describing the studies. Once a study has been identified,

users can explore all of the metadata provided for the study, the full study report, as well as contact information for the contributor. To facilitate this, the web interface has been designed to be intuitive and easy to use, and a user manual has been made available.

## 4 Expected benefits

The new functionalities of the RD offer access to a database of systematically characterized LCA studies to a broad range of users. It is hoped that this new feature of the RD will contribute the following in particular:

- To make the identification of relevant LCA studies easier for all users: metadata describing the scope, goals, assumptions, compliance declarations, and results of the studies can be searched for; LCA practitioners (e.g., policy-makers, business) will be able to easily find not only studies related to their area of interest but also studies that adopted relevant methodological decisions; eventually, this should lead to more robust methodological decisions in future LCA studies; sectorial cross-fertilizations of LCA practices are also foreseen;
- To facilitate the identification of specific relevant information on LCA studies: it will no longer be necessary to read the entire report in order to find this information as metadata will provide first insights on a few key aspects;
- To allow LCA beginners and nonexperts to learn and understand more about LCA methodology and LCA practices by giving access not only to theoretical concepts but also to practical applications;
- To allow LCA professionals and study commissioners to publish their LCA studies in an international, non-commercial platform: this allows contributors to share knowledge and results of studies, and to promote their know-how; and
- To promote high quality LCA studies via a transparent and systematic characterization.

With the enhanced scope and new functionalities for entering, characterizing, and updating entries in the RD, along with the provision of a user-friendly, searchable database of LCA studies, the EPLCA furthers its aim of promoting Life Cycle Thinking and practice.

## 5 Outlook

The application has been tested with a sample of LCA studies. The JRC will maintain and update the application as needed. The JRC will also be the first contributor of the new section of the RD by populating it with its own LCA studies, including author manuscripts of conferences and

**Table 2** Fields and enumeration lists of the “Review and Compliance” section

Field	Enumeration list
Review type	No review, dependent internal review, independent external review, panel review, independent internal review, other (please specify)
Separate review report	No; yes, disclosed; yes, not disclosed
Compliance	ILCD A, ILCD B, ILCD C1, ILCD C2 (European Commission 2011), ADEME BX30-323 (AFNOR 2011), ISO 14040, ISO 14044 (ISO 14044 2006), PAS2050 (BSI 2011), other (please specify)

journal articles. An open call will be sent to research groups and organizations requesting them to further populate the RD. The new section will be useful to users only when it is populated with a sufficient number of LCA studies. The JRC also plans to develop new functionalities for this section of the RD to extend its scope. In particular, it should be possible in the future to upload and describe using metadata new types of life cycle-based documents such as ecodesign criteria and ecolabel criteria.

In the future, this application could also be used by organizations that own and publish LCA studies on their websites (e.g., scientific journals, governmental bodies, businesses, and consultancy firms) to characterize and organize these LCA studies.

**Acknowledgments** This work has been partly supported by DG ENV of the European Commission. We gratefully thank Fulvio Ardente, Nathan Pelletier, Karen Allacker, Marco Recchioni, and Camillo De Camillis for inputs concerning the structure and functionalities of the resource directory. Thank you to Nathan Pelletier and Susanna-Michelle Van Andel for the editorial inputs. We also thank Patrick Arnold, Konstantins Bogucarskis, and Marco Guaita for the IT support.

**Conflict of interest** The authors declare no conflict of interest.

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The views expressed in the article are personal and do not necessarily reflect an official position of the European Commission.