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Need for the use of Standards for Life Cycle Assessment Data Bases

ABSTRACT

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Need for the use of Standards for Life Cycle Assessment Data Bases

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ABSTRACT

One of the objectives of the CASCADE (Cooperation and Standards for Life Cycle Assessment Data in Europe) project is to use the existing Product Data Management (PDM) standards for the Life Cycle Assessment (LCA) data in order to create the model for a reference database, to test it and to develop a repository for terminology.

A collaborative work between research, government and industrial organisations will develop the information model for a generic LCA database and the procedure for implementing it. A data base prototype will be tested with some trial population and useful suggestion will be taken for further standards development

Besides, training tools and software demo will be developed for enlarging the number of the users and gather more interest; the software will have a commercial use after the end of the project.

CASCADE NETWORK

CASCADE is a Thematic Network to establish the necessary standards for Life Cycle Assessment (LCA) data.

The Network includes organisations expert in LCA, Material, Product Data Technology and Information Model: Italian National Agency for New Technologies, Energy and the Environment, ENEA (I); Chalmers University of Technology, CPM (S); 2.-0 LCA Consultants (DK); PRè Consultants BV (NL); ECOBILAN (I) Environment Agency, EA (UK); Institute for Energy and Environmental Research IFEU (D); Italian National Agency for Environmental Protection ANPA (I); Ferrodag Limited (UK); CAESAR System Limited (UK); POSC/CAESAR Association (NO); Experimental Institute for Light Metals ISML (I); Rolls-Royce (UK).

CASCADE OBJECTIVE

Life Cycle Assessment (LCA) is the basic tool to evaluate and assess the environmental aspects and potential impact throughout a products' life. The LCA data will be gradually used to design new products with low environmental impact. This will have a strong impact on the SMEs that will not adequate their production to the problem of *"selling not only product but also the data related to the product itself"*.

LCA requires a massive amount of validated and structured data about materials, processes, energy, transportation, emissions, waste recovery and disposal scenarios, etc.

Different sources developed their data systems using

different software and system platforms, so each data system has a different internal representation for the data that it contains. The result is that data from different sources cannot be combined and used efficiently without a great deal of uncertainty, extra work and additional costs. In addition, data representations for LCA need stability, longevity and independence from any computer system because the lifetime of the data is longer than the lifetime of the computer systems that they depend on.

LCA data standardisation allows reducing the cost of data for users and increasing the availability and reuse of data.

The objective of the CASCADE Network is to make use of the existing standards -developed in the framework of the ISO TC 184 technical committee- and adapt them to the need of the Life Cycle Assessment (LCA) data in order to create common tools and reference databases specific for the LCA.

In the project the main aims are to:

- facilitate the exchange and dissemination of knowledge among LCA community, product designers and experts on computerised representation of material, product and process data;
- define the specifications for European LCA reference databases using International Standards and contribute to their definition;
- develop tools, web site, software demo and training packages, for improving the reliability and applicability of LCA for the European products and manufacturing processes;

- define a detailed exploitation plan and disseminate the results.

DESCRIPTION OF THE WORK

The work includes the definition of a common method to specify LCA data in databases that will be used by product designers and practitioners in LCA. It will be based on the Code of Practice of the Materials database Demonstrator Programme and will bring together existing standards, particularly ISO 10303 Standards for Exchange Product data, ISO 13584 Parts Libraries, ISO 15926 Reference Data Library and ISO 15531 for computer – understandable data and ISO/TS 14048 for the LCA data documentation format [1].

CASCADE will take advantage of the relevant knowledge already developed by the partners throughout activities funded by other sources, beside this project and taking into consideration that the methodology for publishing semantics on the web is a fast moving field and technologies such as RDF (Resource Description Framework), OIL (Ontology Interchange Language) and DAML (DARPA Agent Markup Language) are rapidly gaining acceptance. These technologies are soon to be brought together into the Web Ontology Language ('OWL'), [2, 3]

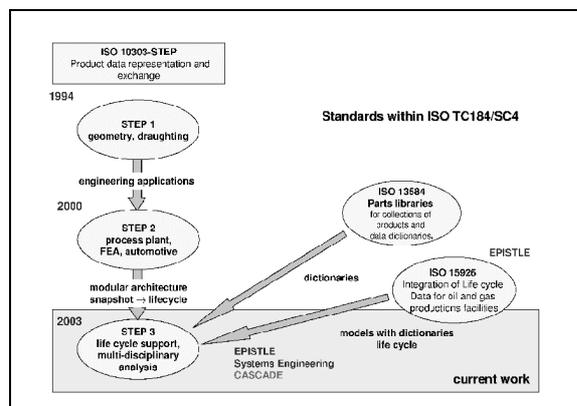


Fig. 1 Recent progress on Product Data Technology

The idea is that the information model of the LCA data base is defined following very strict rule that are compliant with the ISO TC 184 standards family. The database is then built with the contribution of everybody who can send its own information structured as it is foreseen by the information model. At last, the web administrator verifies the correctness of the new data and inserts them in the web. So it is important that the experts of LCA and Product Data Technology work together in this direction.

The network should be able to define a standardised document format (XML DTD) for the web publication of

LCA data. XML is now spreading in the entire world for experts who need to exchange through the web structured data. This will enable LCA data to be accessed using standard web browsers. Furthermore, the ISO 10303 offers all the range of standards to develop metadata for product and processes. There will be the need to develop simple tools for collecting LCA data from the web, but the owner of the data would not allow everybody to collect them but only their customers that will pay for them. For example, it could be developed an XML file that SMEs can ask their supplier to fill in order to purchase the product. The modular approach defined in the ISO TC 184 committee should enable to describe the modulus for any elementary activity.

The network will develop LCA tools such as: web site, software demos and training and education packages.

The web site is a tool for both project management and the spreading of LCA knowledge.

The software demo contains two parts:

- a system for the management and integration of reference data: this system will allow the integration, browsing and editing of reference data (created by the domain experts) relevant to life cycle assessment;

- a demonstration system that manages the life cycle assessment data for a product: this system will be used to validate the information model for the life cycle assessment data and to demonstrate its effectiveness. The semantics of the life cycle assessment data for a product will be defined by links to the reference data. This will be a training tool initially, but will have a commercial use after the end of the project.

The specific long distance training packages will represent an efficient tool for education and training of product designers, LCA experts and software developers. The long distance training will be particularly useful for the SME's employees that hardly have time to follow traditional courses that will take them away from the work for too long time.

PRESENT WORK

The LCA experts are now working on the definition of the scope and sources for the core Reference Data Library (RDL- ISO 15926).

Reference data are data that represent information about types of things (classes) or individuals which are common to many process plants or things and which is of interest to many users. The scope of LCA reference data is to define data that are commonly used in exchange and integration of data. Candidate sources will be typical LCA data sets including SPOLD and SPINE formatted sources, standard descriptions of materials, material types, product-use

scenarios and testing and measurement procedures used by LCA data sets. This is supposed to be the core set of data to be used both as a test for the correct implementation of the information model and software demonstration, and as an example for the further development of the database.

So it is necessary to identify and study the relevant LCA databases in order to contribute to take them into account in the development of the CASCADE data format (ISO/TS 14048 + IA98) [4].

LCA reference data identified during the work will be added to the already existing set of reference data of ISO 15926-4. The work consists of creating a unique record in ISO 15926-4 for each of the identified terms, including precise definition and appropriate associations.

Furthermore, the LCA experts are developing a “procedural guideline for collection, treatment, and quality documentation of LCA”.

The purpose of this guideline is to improve the quality and comparability of the data used in environmental product life cycle assessments. It provides technical guidance and recommendations for the procedures to be used for data collection and data treatment, and includes a list of minimum requirements for data quality documentation. This is supplemented by a procedure for certification of data according to the guideline.

The outline for this guideline was originally produced by the CODATA Working Group on Environmental Life Cycle Inventories, and resulted from a discussion at a working group meeting, which took its starting point in a draft document later published [5].

The guideline also defines a *description of a process*. An important aspect during a description of process is the data base information model. LCI (Life Cycle Inventory) -data is data that describes environmentally relevant in- and outflows of a defined model of a process. Matter and energy flows expressed by a functional unit or a functional flow have to fulfil a function described in the model.

The use of ISO/TS 14048 standard for LCA data Documentation form will facilitate the exchange of LCI data without loss of transparency [6]. This specification does not provide specific requirements for implementation of data exchange. However, the use of a standard information model will allow the data exchange and the data communication among different systems independent from the software and/or hardware used. At the same time the implementation of the standard information model will be fully consistent with the data documentation requirements herein. Although primarily intended for documentation of life cycle data, the data documentation format can also be used for the management of environmental data, e.g. for reporting, performance

assessment and benchmarking. If from practice or in general the need for a broader use of data documentation format arises, the data format and its structure may be expanded to include additional information, such as environmental performance evaluation, health and safety, and life cycle costing.

In particular, documentation of processes should include:

- the documentation of the process itself in terms of process description and input – output data;
- the documentation regarding the modelling and its validation;
- administrative information.

In order to describe a process it is necessary to provide the list of information according to ISO 14048. The standard gives also guidance on the main technical issues related to the process description and modeling, such as the definition of system boundaries, the allocation, the relationship between stocks and flows as shown in the table below.

Table 1 Standards for process description in LCA

ISO/TS 14048- Process Description		
Name		
Class	<i>Name</i> <i>Reference to nomenclature</i>	
Quantitative reference	<i>Name</i>	
	<i>Unit</i>	
	<i>Amount</i>	
Technical scope	<i>Type</i>	
Aggregation type		
Technology	<i>Technology descriptor</i>	
	<i>Technical content and functionality</i>	
	<i>Technology picture</i>	
Process contents	<i>Included processes</i>	
	<i>Intermediate product flows</i>	
	<i>Source process</i>	
	<i>Input and output source</i>	
	<i>Input and output destination</i>	
	<i>Destination process</i>	
Operating conditions		
Mathematical model	<i>Formulae</i>	
	<i>Name of variable</i>	
	<i>Value of variable.</i>	
Valid time span	<i>Start date</i>	
	<i>End date</i>	
	<i>Time span description</i>	
Valid geography	<i>Area name</i>	
	<i>Area description</i>	
	<i>Sites</i>	
	<i>Geographical Information System (GIS)</i>	
Data acquisition	<i>Sampling procedures</i>	
	<i>Sampling sites</i>	
	Sample Volume	<i>Relative</i>
		<i>Absolute</i>

FUTURE DEVELOPMENTS

The project will be a success if the database continues to be implemented after the end of the project by becoming the principal working tool for LCA. The use of the database as a working tool will involve:

- continual enhancement of the database content by research organizations;
- the creation of a self funded organization that can make the content of the database available to industry, including SMEs, at low cost;
- the development on a commercial basis of further LCA training materials and tools, which will help industry, including SMEs, to use the database for the achievement of environmental certification.

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