August 31, 2011

Defining the goal and scope of the LCA study

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The first phase of an LCA study consists of defining the goal and the scope of the study. This is a very important part in the LCA, as it determines and guides the choices to be made in the other phases of the study. Therefore it is recommended to spend sufficient time in this phase, to clearly define what is the purpose of the study, the intended use of the results and what should be included. In the end, this will save time in the other phases of the work.

It should also be noted that during the course of the study it may be necessary to come back and redefine the goal and scope when more knowledge has been acquired about the product system. Issues and information that were not known or could not have been foreseen in the beginning of the work may require that the goal needs to be reformulated. , For example, original goal set for the study might not be possible to fulfil. This reflects the iterative nature of LCA.

Defining the goal of the study

The ISO 14040 standard states that the **goal of the study** should define:

- The intended application and the reason for carrying out the study
- The intended audience, i.e. to whom the results are intended to be communicated
- Whether the result is intended to be used in comparative assertions disclosed to the public

The goal is defined together with the commissioner for the study. A clear description should be acquired of the commissioner's reasons for carrying out the study, and the intended applications and audience for the result from the study. This is the fundamental basis for determining the scope for the study.

The intended application and reasons for carrying out the study could for example be that an LCA will be done for the first time for a particular product to identify where in which life cycle the main environmental impacts occur. Example of questions that can be posed are; What types of environmental impacts are dominating for the products? Which steps in the life cycle stands for the the major contribution to the products total impact? What can be done to improve the product's overall environmental performance?

The intended audience could for example be that the result is only to be used for internal purposes as input to product development, or that result is to be used in external communication for the purpose of informing customers or consumers, etc.

A *comparative assertion disclosed to the public* is a statement that claims that a product's environmental performance is equal or better than competing products which performs the same function. Since this is a fairly critical statement, there are certain specific rules that must be applied for this type of LCA to be valid. They include specific reporting requirements and requirements on that a critical review must be performed by a group of interested parties or stakeholders; referred to as the review panel.

Defining the scope of the study

The scope should describe the detail and depth of the study, and show that the goal can be met with the actual extent of the limitations. When defining the **scope of the study** the following aspects should be considered and described:

- The product system
- The functions of the product system, the functional unit and reference flow
- System boundary
- Allocation procedures
- Environmental impact assessment methodology and types of impacts, and interpretation to be performed
- Data requirements
- Assumptions and limitations
- Data quality requirements
- Critical review considerations
- Type and format of the report required for the study

Some of these aspects are further described below. LCA is an iterative technique, and as data and information are collected, various aspects of the scope may require modification in order to meet the goal of the study.

Function, functional unit and reference flow

The *function* delivered by the product system is expressed by the *functional unit.* This is a very important element of the LCA, and has to be clearly defined in the study. The functional unit is a

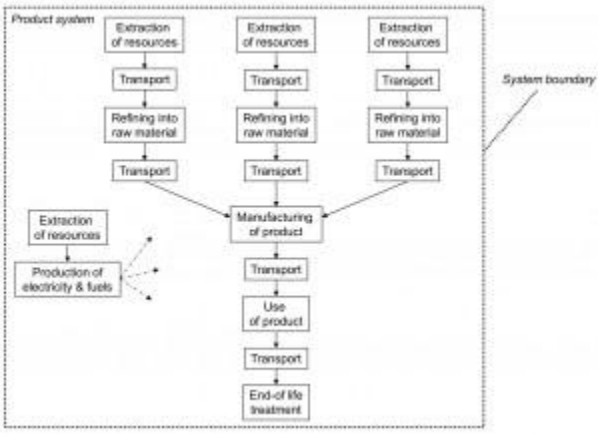
quantitative measure of the function of the studied system. It provides a reference to which the inputs and outputs to the product system are related. This enables comparison of two different product systems.

For example, the function of paint is to keep a surface protected. In this case the functional unit for a paint system may be defined as 5 m2 unit surface protected for 10 years. A comparison of the environmental impact of two different paint systems with the same functional unit is then possible, where the two systems may have different technical properties concerning durability, maintenance etc.

The *reference flow* is a physical flow of energy or materials that is needed to fulfil the functional unit. In the example of a paint system, the reference flow would be the amount of paint that is needed to keep 5 m2 unit surface protected for 10 years. And in comparison of different paint systems, the amount of paint needed to fulfil the same function can vary depending on different technical properties of the paints.

Product system and system boundaries

The system boundaries defines which unit processes that is included in the product system, as well as which inputs and outputs that should be included. The selection of which processes to include in the system depends on the goal for the study and the intended application of the results.
In practice, the work with defining system boundaries is aided by



developing an initial flowchart of the product system, which shows the processes to be included in system as well as how they are connected. This facilitates the understanding of the system. The initial flowchart is also the basis for the next phase of the LCA, the inventory analysis, where data is collected for each process in the chart.

Most technical activities are interrelated, and therefore it needs to be clearly defined what activities and which inputs and outputs to include, and what can be excluded. This is important to limit the scope of the work and to focus the efforts. Exclusion of parts of a system or inputs and outputs are

called “cut-offs”. The exclusion of parts of the life cycle must, however, always be motivated and be based on the goal of the study. For example, in an LCA of a product the construction and building of the production site and capital equipment is often excluded due to the fact that this is assumed to have a small impact on the overall result. This as the environmental impact of construction and equipment is distributed on all products produced in the site by the equipment; which can have a very long life span.

Regarding inputs and outputs it needs to be specifically defined *what inputs and outputs that should be included from and to the environmental system*, i.e. elementary flows. A life cycle for a product usually begins with the extraction of material and energy resources from environment. Then the different production and transportation steps in the life cycle generates emissions that ends up in the environment; in air, water or ground. Also, waste is generated that needs to be managed. The life cycle of a product usually ends in some end-of-life treatment, that ultimately may end up in the environmental system; for example through leakage from landfills, or through emissions from waste incineration.

In practice, the choice of inputs and outputs that originates in or ends up in the environmental system is determined by how the *environmental impact assessment* should be performed, and what environmental impacts that should be studied in the LCA. This may also involve geographical or time related considerations, e.g. the sensitivity of ecosystems to environmental impacts can differ regionally, or pollutants may have a different lifespan in the atmosphere.

Allocation

Allocation means partitioning inputs and outputs to the product under study. This will be necessary for processes that produces more than one product. In this case the inputs of materials and energy measured for the process as as whole, as well as environmental releases, must be allocated to the different products produced by the process. The principles for allocation should be decided as part of the goal and scope, and be consistently applied in the study.

Some further details on different methods for allocation is available in the “Inventory” part of this getting started guide.

Data quality requirements

The usefulnes and reliability of the results from an LCA study depends on the quality of the data that is used as basis, i.e. the data that decribes the included processes in the the different parts of the product system. Therefore it is important to define data quality requirements, i.e. the level of data quality that is needed to fulfil the goal of the study. In practice this means defining the ambition level for the work with data collection in the next phase of the study; the inventory phase. It needs to be defined what data that should be collected, and how and where the data should be collected.

According to ISO 14044, the following quality aspects should be addressed and described when defining the scope:

- *Time-related coverage;* i.e. what time period should the data represent?
- *Geographical coverage;* i.e. what geographical area or region should the data represent? In a typical life cycle of a product, the production of materials often take place in different parts of the world.
- *Technology coverage;* i.e. for the included processes, what is the level of technology used to produce materials and products? For example; different types of technologies may be used to produce a material that is included in the study and it therefore needs to be decided what technology that should be used in the study; e.g. best available technology, general industry practice, etc.
- *Precision, completeness and representativeness of the data*
- *Consistency and reproducibility of the methods used throughout the study*
- *Sources of the data;* i.e. from which sources should data be collected? For example, data can be collected from inhouse information systems, suppliers, industry associations, commercial LCA databases, etc.
- *Uncertainty of the information and data gaps;* i.e. how should uncertainties in data and data gaps be handled?

Source: http://www.tosca-life.info/getting-started-guides/life-cycle-assessment/how-to-perform-an-lca/phases-in-an-lca-study/goal-and-scope/