What is Life Cycle Assessment?

Life cycle assessment (LCA) is the systematic analysis of the environmental impact of products during their entire life cycle. The life cycle of a product comprises of production, use and disposal phases. Environmental impacts are evaluated throughout, also including the upstream and downstream processes associated with the production (e.g. production of raw, auxiliary and operating materials) and with the disposal (e.g. waste treatment). Environmental impacts refer to all relevant extractions from the environment (e.g. ores and crude oil), as well as emissions into the same (e.g. wastes and carbon dioxide).

What can life cycle assessment do for you?

- Compare environmental impacts of various products
- Optimize processes with regard to ecological aspects, (increased efficiency → costs)
- Compare environmental impacts of various raw materials and substances
- Evaluate the environment-relevant aspects of transport processes
- Give backing to marketing of environment-friendly products or processes
- Provide support with environmental reporting and certification (EMAS II, Product certification, environmental product declaration)
- Provide help with creating a sustainable line of products

What are the special terms of life cycle assessment?

**System boundaries (Goal & Scope)** – Description of the product’s life cycle phases and the cut-off criteria delimiting the system under investigation.

**Functional Unit (FU)** – Reference unit of the system; environmental impacts are evaluated based on this unit. E.g. 1 kg product, annual output, 1kg*km, etc.

**Life Cycle Inventory Analysis (LCIA)** – Assembly and quantification of inputs (resource and energy flows) and outputs (emissions and wastes) into and out of the system.

**Impact Assessment** – Evaluation of environmental impacts based on LCIA, and displaying the results in impact categories.

**Impact categories:**
- **Global Warming Potential** (GWP), expressed as CO2-equivalents [kg];
  → Global warming
- **Acidification Potential**, expressed as SO2 equivalents [kg];
  → Acid rain / forest decline;
- **Eutrophication Potential**, expressed as PO4 equivalents [kg];
  → Over-fertilization of the soil or water;
- **Ozone Depletion Potential**, expressed as R11 equivalents [kg];
  → Thinning of the ozone layer in the upper atmosphere;
- **Photochemical Ozone Creation Potential** ("Summer Smog"), expressed as ethene equivalents [kg];
  → Ozone formation in the lower atmosphere;
- **Primary energy** [MJ], renewable and fossil energy sources (on the input side)

**Interpretation and reporting** – Displaying the environmental impacts of a report according to ISO 14040/44 standards.

**Critical Review** – Critical assessment by an independent expert to verify the data and to increase credibility of results.

---

**Modular design of an LCA according to ISO 14040/44.**
How is data collected for LCAs?

What is the chain of events leading up to a complete LCA study?

- The flow chart of the system to be analysed is provided by the customer.
- On the basis of the flow chart, PE INTERNATIONAL works out a questionnaire for analysing the material and energy flows of the process cycle.
- The customer collects data with the support of PE INTERNATIONAL.
- PE INTERNATIONAL creates a model resulting from the collected data with the self-developed software solution called GaBi.
- The developed model is evaluated regarding its potential environmental impact.
- A critical review is possible in order to examine the ISO conformity and to increase the reliability of the study.

What are the requisites for data quality?

- Correct units and their reference values (base year, production units etc.)
- Reference to a single, well-defined functional unit
- Adequate precision
- System-relevant material and energy flows

What are the options for collecting data?

1. Data collection based on a "Black Box" process, summarizing the entire process chain
2. Data collection for each individual process in the chain separately