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TenStep Supplemental Paper

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Theory of Lifecycle Analysis

Lifecycle Analysis is both a concept and a tool to systematically assess the impact of a product and its lifecycle on the environment.

First, a few definitions are necessary (as per the ISO 14040 draft):

Lifecycle - consecutive and interlinked stages of a product or service system, from the extraction of natural resources to the final disposal.

Lifecycle Assessment - A systematic set of procedures for compiling and examining the inputs and outputs of materials and energy and the associated environmental impacts directly attributable to the functioning of a product or service system throughout its lifecycle.

The basic procedure is relatively straightforward in concept - examine the entire system, evaluate the impact, and choose the best option. However, in actual practice, there are a number of difficulties. Each of the keywords used in describing the procedure needs careful definition, or the results obtained may be different. The system must be defined so that the entire lifecycle is included, or else important effects may be neglected. Alternatively, smaller systems with equivalent inputs and outputs can be compared.

Why perform LCAs?

LCA can identify key process steps and, most importantly, key areas where process changes, perhaps enabled by R&D, could significantly reduce impacts. Analysts can use the results to help characterize the ramifications of possible policy options or technological changes.

LCAs might be conducted by an industry sector to enable it to identify areas for improvements, in environmental terms. Alternatively, the LCA may be intended to provide environmental data for the public or for government. In recent years, many major companies have cited LCAs in their marketing and advertising to support claims that their products are 'environmentally friendly' or even 'environmentally superior' to those of their rivals.

The most important time for LCA information to be taken into consideration is at the design stage of new products. Where LCA is used to evaluate procedures rather than products, the information can help ensure that appropriate choices are made.

Steps in LCA

The LCA methodology is described in detail by the Society of Environmental Toxicology and Chemistry (SETAC) and CML (University of Leiden). In SETAC's Code of Practice, it is recommended that the LCA be split into five stages:

1. Planning
    - Statement of objectives

- Definition of the product and its alternatives
- Choice of system boundaries
- Choice of environmental parameters
- Choice of aggregation and evaluation method
- Strategy for data collection

2. Screening
   - Preliminary execution of the LCA
   - Adjustment of plan
3. Data collection and data treatment
   - Measurements, interviews, literature search, theoretical calculations, database search, qualified guessing
   - Computation of the inventory table
4. Evaluation
   - Classification of the inventory table into impact categories
   - Aggregation within the category (characterization)
   - Normalization
   - Weighting of different categories (valuation)
5. Improvement assessment
   - Sensitivity analysis
   - Improvement priority and feasibility assessment

The first stage is extremely important since the result of the LCA is heavily dependent on the decisions taken in this phase.