

## Life Cycle Assessment

Looking at a product from all the various aspects of its life cycle is critical to ensure the total picture of benefits and impacts is understood. Failure to look across the entire life cycle when making decisions can lead to unintended consequences and often fail to solve the issue of concern. Dissecting a product into all the various processes that contribute to its production and disposal can help us better understand how our production and consumer habits affect the environment.

Consumption of products drives an array of extraction, manufacturing, processing, use, transportation and disposal operations. An analysis of these operations, called 'life cycle' or 'cradle-to-grave' analysis, documents the inputs (water, energy, raw materials) and outputs (products, transportation and wastes), for these various steps. Life cycle analysis (LCA) has most often been used to compare two or more products, such as plastic vs. glass vs. aluminum beverage containers, for their impact. This type of analysis can point out strengths and weaknesses in the production, use, and disposal/ recycling steps.

While LCA can be used as a comparative tool, comparing energy usage between plastic, glass and aluminum beverage containers, for example, it does not provide a way to rank the importance of the factors examined. For example, what should be ranked highest in importance in maintaining a healthy environment: energy usage, air quality, water quality, solid waste? How do we compare the environmental impact of a manufacturing process that generates waste or consumes water or emits greenhouse gases? Equally important are the economic, employment and social issues tied into this evaluation of impact. What is the impact and trade-off for each of these items at each stage in the life cycle?

In addition to trade-offs, boundaries must also be clearly established. Within these boundaries, decisions need to be made concerning what data will or will not be gathered for any environmental assessments. For example, erosion, loss of habitat and biodiversity, groundwater contamination, generation of global warming gases, need to be evaluated. While considering the inputs and impacts of growing corn for ethanol production is appropriate, should the inputs and impacts of the people needed to grow the corn (their food, shelter, etc.) be included. Once the lists of what to include, and what not to include are developed, a mass balance determination is performed.

Establishing trade-off rules and boundaries is critical to success. However, despite the availability of an ISO standard on LCA, not all life cycle assessments are conducted using that standard. In addition, assumptions and boundaries can be defined differently in different assessments. These facts make it difficult and unwise to try to compare one life cycle analysis to another group's work.

For example, this analytical technique has been adopted by some manufacturers who hire private research firms to conduct LCAs for their products. With a growing environmental consciousness on the part of consumers, marketing a product as "environmentally-friendly" can mean money in the bank for manufacturers. As an example, three LCAs

have been conducted on cloth vs. disposable diapers by separate firms hired by different groups. Each analysis came out with different results and each group marketed their products using the numbers from the studies they backed. This has raised great concern in scientific and environmental circles. The assumptions and boundaries used in any LCA must be transparent to avoid confusion and misuse.

A life cycle analysis must be combined with trade-off rules, boundaries and critical thinking. Understanding the purpose of the analysis and the good or service delivered allows for a good comparative analysis. However, there are a number of potential problems that must be considered to ensure good results.

- Understand the data reliability and quality will vary greatly and acknowledge this transparently
- Clearly articulate the scale (e.g. global, local)
- Understand that uncertainty is everywhere – an LCA will be refined as more and better quality data is available
- Due to differing assumptions developed up front: comparisons between studies difficult
- No single, globally accepted method exists for LCA work

To help alleviate concerns over the trend to use LCA as a marketing tool, the Society of Environmental Toxicology and Chemistry (SETAC) has established guidelines for conducting LCAs by both governmental and private agencies, as well as developed a code of ethics. It is suggested that DTSC consider following this type of standard.

LCAs are a powerful tool to help identify potential impacts across a variety of environmental and social dimensions of a product's full life cycle- earth to earth. Without this analysis, reductions in one aspect may result in increased pollution in other aspects of production. LCA studies have limits, but they are the best method to ensure a complete product benefit and impact evaluation is done.