2.1: Introduction to Life Cycles

Green chemistry, in addition to being a science, it is also a philosophy and nearly a religion. Attendance at American Chemical Society Green Chemistry & Engineering Conferences will instill such an ideal into any attendant because of the universal appeal and possibilities in this novel approach to radicalizing the business of doing science and engineering. Life Cycle Assessment (LCA) is a comprehensive life cycle approach that quantifies ecological and human health impacts of a product or system over its complete life cycle. It uses credible scientific methods to model steady-state, global environmental and human health impacts. It also helps decision-makers understand the scale of many environmental and human health impacts of competing products, services, policies or actions.

Please see for more information https://www.youtube.com/watch?v=NQTW7jjXVmE (LCA: Intro to Life Cycle Assessment. (2013).)

Triple bottom line (economic, social, and environmental)

Triple Bottom Line accounting enables enterprises to support sustainability analysis in their operations, products and services. LCA contributes to the Triple Bottom Line reporting by quantifying the ecological and human health performance of competing products and services (Figure 2-1). Adding the social and economic performance reporting of a product or service to the LCA results of the product or service is one way to deliver Triple Bottom Line reporting.

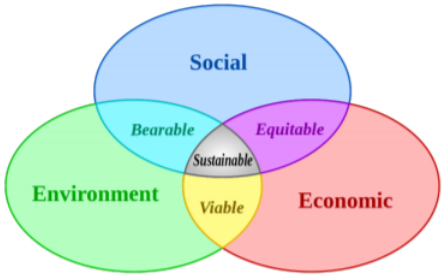

Figure 2.1.1: The triple bottom line in GC containing social, economic, and environmental Venn diagram whose intersection contributes to a valid sustainability analysis.

LCA for Decision Making

Who makes decisions

- Company product managers or planners
- Company procurement and purchasing
- Industrial sector consortia (example: aluminum manufacturers)
- Regional or national policy makers
- Consumers, customers and product users

Primary drivers and expectations for LCA:

- Learning about the environmental performance of products and services
- Minimizing production and regulatory costs

- Minimizing environmental and human health damage
- Understanding trade-offs between multiple impact categories and product phases
- Supporting equitable economic distribution and profitable operations

Types of decision situations

- strategic planning and capital investments
- (green building, waste management)
- eco-design, product development
- operational management
- (green procurement)
- communication and marketing
- (eco-labeling, product information)

Eco-labels:

- Type 1: Third-party certified multi-criteria environmental labeling. Example: Forest Stewardship Council label for wood products
- Type 2: Environmental self-declaration claims. Example: Single issue claim such as the "bio-degradable" label
- Type 3: Independently verified label with preset quantified indices. Example: Numerical water consumption rating for a dish washer

Eco-labels that require LCA:

Type 1) Third-party certified multi-criteria environmental labeling

Type 3) Independently verified label with preset quantified indices

Life Cycle Assessment (LCA) enables the creation of Type 1 and Type 3 eco-labels. These eco-labels can be powerful tools in obtaining larger shares of a specific market sector. Life cycle assessment (LCA) is a standardized programmatic tool to determine the environmental impacts of products or services. It can be described by a four-part framework as outlined by the 14044 ISO standard.

Life cycle assessment Framework

1. Goal and scope definition
2. Life cycle inventory
3. Life cycle impact assessment
4. Interpretation

This integrated framework was inspired by earlier forms of life-cycle thought from life cycle financial analysis. Examining a product from origination to use and disposal provides more holistic analysis to identify where environmental impacts originate and guide efforts in reducing impacts.

The ISO standards (http://www.iso.org/iso/home/standards.htm) provides guidance on structure framework, reuse requirements of data, study assumptions, and methods. By using more standard LCA methodologies, studies are more comparable and of greater scientific rigor. A standardized method allows LCA practitioners to manage complex datasets, provide comparisons among products, and allow benchmarking. In the absence of a standardized method, the results of LCA studies are even more variable depending on study assumptions and methods. The ISO standards help reduce the influence of the practitioner influence on study results.