Chapter I
Life Cycle Design, Planning, and Assessment

Raymond R. Tan
De La Salle University, Manila, Philippines

Alvin B. Culaba
De La Salle University, Manila, Philippines

Michael R. I. Purvis
University of Portsmouth, UK

Joel Q. Tanchuco
De La Salle University, Manila, Philippines

ABSTRACT

Energy and environmental concerns are intricately linked to the supply chains of various goods. Increased public awareness of such issues is reflected in the contemporary business environment as well as government legislation. Companies must not only comply with environmental regulations, but also contend with the need for increasingly green corporate practices in order to stay competitive in global markets. Thus, it is necessary to apply systematic techniques to quantify the environmental impacts of supply chains, and to identify opportunities for making improvements. This chapter discusses life cycle assessment principles and its application in the design and planning of industrial supply chains. A specific case study on the production of biofuels from agricultural crops is used to illustrate the key concepts.

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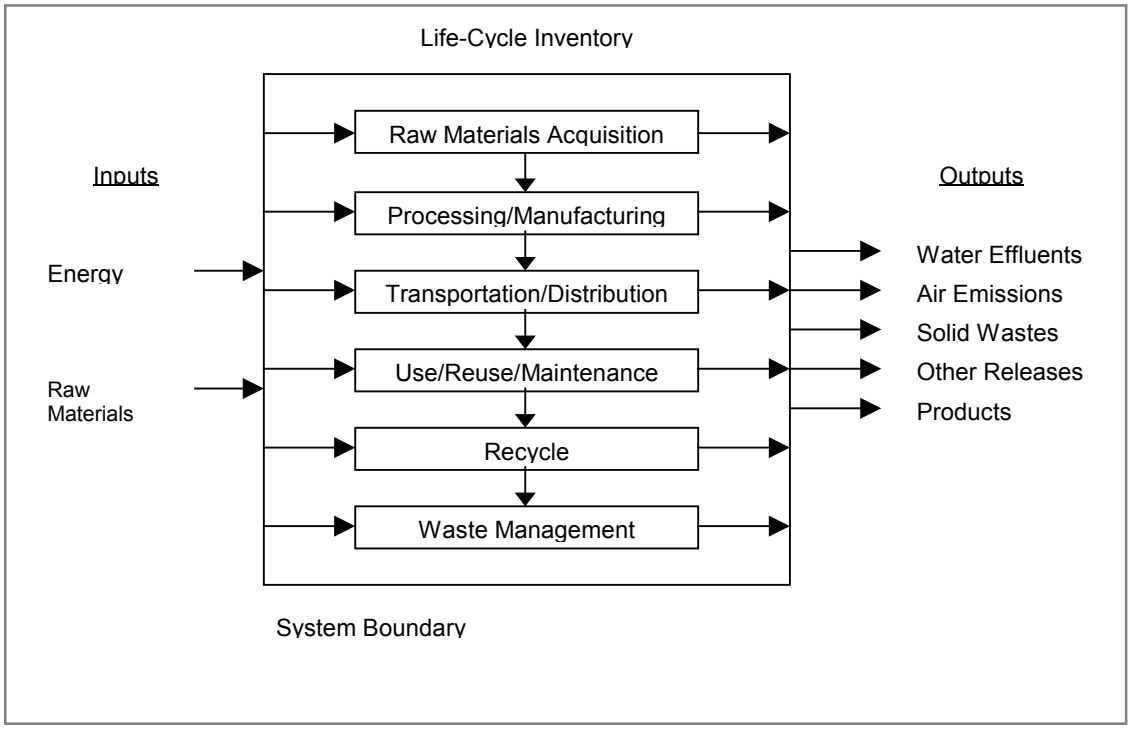
BACKGROUND

The past few decades have seen increased concern for environmental issues by companies, governments, and the general public. This trend was first apparent in regulatory limits on industrial pollutant discharges, which in turn led to the development of end-of-pipe treatment technologies. These techniques focus on the treatment and safe disposal of residues, and are still in use today when regulatory compliance needs to be ensured. However, such activities do not generate any savings or revenues, and are thus understandably viewed by companies as cost centers. In recent years, there has been considerable interest in pollution prevention (P2) or cleaner production (CP), in addition to pollution control. P2 or CP entails the use of strategies which attempt to give inherently clean solutions in order to minimize the need to treat wastes and residues. There is often the associated benefit of reducing the consumption of raw materials and utilities, which potentially generates cost savings in addition to environmental benefits. Examples of strategies used to achieve P2 or CP include:

- Use of environment-friendly materials;
- Product or process modifications to improve efficiency and reduce attendant environmental releases;
- Optimal operation of processes to minimize consumption of energy or raw materials and generation of waste; and
- Implementing exchange of waste streams between process or plants to achieve industrial symbiosis.

Any P2 or CP strategies to be implemented must be evaluated using systematic procedures to assess the potential environmental benefits

Figure 1. A generic life cycle system (Adapted from SETAC, 1991)



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