

Background

Life-cycle assessment (LCA) is essential to designers, managers, and other decision-makers and environmental stakeholders for determining the environmental implications of products, services, and processes. Currently, two LCA approaches are most common: one is based on detailed process model descriptions and corresponding emissions and wastes, while the other is based on economic input-output data and publicly available resource consumption and environmental discharge data. Both approaches have advantages, but unfortunately, also have major limitations.

Statement of Work

We propose to develop hybrid LCA models that will overcome the major limitations of the two existing methods so that LCA can help inform environmental, design, and business decisions. We will integrate the models such that the hybrid solutions (1) include *detailed* process-level environmental data as well as *economy-wide* (supply chain) environmental impacts, (2) have environmental and economic information about the *major products and processes* in the economy, (3) *quantify a wide range* of environmental data, and (4) *provide answers to all decision-making groups*, including designers, managers, regulatory agencies, consumers, and public policy-makers.

Approach

We will demonstrate the utility and comprehensiveness of hybrid models by applying them to specific life-cycle studies from different sectors of the economy: plastics (basic materials), car batteries (consumer products), and distribution of goods by truck, air, rail and waterways (service sectors). We will apply to these case studies each of the hybrid models developed. The objectives are (1) to determine which of the three hybrid LCA models lead to more comprehensive and less uncertain results for a given application, or category of products (e.g., services), (2) to find out which hybrid LCA models are useful to what level of decision making (e.g. facility managers vs.

EPA regulators), and (3) to determine the accuracy and comprehensiveness of hybrid LCA models against the stand-alone process-based and EIO-LCA models.

We will address uncertainties in modeling and associated data sources by analyzing several major issues: (1) lack of comprehensiveness due to exclusion of much of the supply chain effects in process model-based LCA, (2) outdated resource consumption and environmental data, and (3) problematic international comparisons.

LCA Interface

This research will provide information that could contribute to more informed decisions concerning choices among materials, processes, products and services in order to improve environmental quality and promote sustainable development. Computer interfaces will be developed to facilitate the practical implementation of the hybrid models. We will take advantage of the World Wide Web to provide *free* access to the hybrid models.

This project will involve the close collaboration of a team of researchers from UC Berkeley's Consortium on Green Design and Manufacturing, Carnegie Mellon University's Green Design Initiative (creators of the EIO-LCA model at www.eiolca.net), and the Institute for Polymer Testing and Polymer Science from the University of Stuttgart, Germany (where the detailed and comprehensive process model-based life-cycle engineering approach called GaBi was developed). This project funded by the U.S. EPA.

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