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## **Book Review**

*Life Cycle Assessment Handbook: A Guide for Environmentally Sustainable Products* edited by Mary Ann Curran. Hoboken, New Jersey: John Wiley & Sons, Inc, and Salem, Massachusetts: Scrivener Publishing LLC, 2012, 611 pp., ISBN 9781118099728, \$199.00 (paper) \$159.99 (e-book).

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This book by Mary Ann Curran constitutes an ambitious attempt to present the current “state-of-the-practice” in life cycle assessment (LCA). LCA started out as an approach to assess the environmental implications of products, and has to date evolved into a standardized method for systematically evaluating the potential environmental impacts of products, services, and technologies. Moreover, recent efforts have focused on expanding the LCA methodology also to capture indirect effects through the use of economic techniques and models (consequential LCA),

and attempt to broaden the traditional LCA framework to integrate environmental, social, and economic aspects into the analysis, also referred to as life cycle sustainability assessment (LCSA). The reader will be impressed by the breadth of topics covered in this book, opening with an introductory chapter on “hot topics” such as, e.g., links of the LCA framework to environmental policy making, or the feasibility of LCA to address questions not only at micro (product) level but also at macro scale. This sets the stage for the subsequent chapters that can be divided into four sections: LCA Methodology and Current State of LCA Practice (Part I), LCA Applications (Part II), LCA in the Context of Decision Making and Sustainability (Part III), and Operationalizing LCA (Part IV). Curran has integrated a series of contributions by leading experts from academia, industry, and LCA consultants into the book. This created some repetition and left some topics unexplained, but the overall message and flow of content was clear and coherent. In particular, I enjoyed the diverse contributions from authors discussing the LCA framework from different professional perspectives. This resulted in an interesting mix of chapters, some of which deal with latest advancements in LCA methodology (e.g., integration of ecosystems goods and services, social LCA, LCSA, LCA and multi-criteria-decision analysis (MCDA)), while other chapters discuss practical applications (e.g., comparison of LCA software tools, LCA in product innovation, the use of LCA in sustainable supply chain management).

Chapters 2 to 6 deal with the four stages of an LCA (goal & scope, inventory analysis, impact assessment, and interpretation), briefly discuss the history of LCA, and provide an outlook to potential future developments. These chapters provide a concise overview of the latest impact assessment methods (Chapter 4) and inventory databases (except for example,ecoinvent 3 or the Social HotSpots Database – both were released after publication of this book) (Chapter 5), as well as software tools and smart data management techniques (Chapter 6). It should be

noted, however, that these chapters are not a “how to” guide with instructions for carrying out an LCA. They instead provide a brief overview of a specific topic (e.g., life cycle impact assessment), and then elaborate on methodological challenges and open questions, and provide an overview of currently available models, data sources, and developments. For readers new to the LCA methodology, I would therefore recommend also to consult one of the many LCA texts available elsewhere (see for example, (Guinée 2002; U.S. EPA 2006; EC JRC 2010; Baumann and Tillman 2004)).

Through a range of case studies, chapters 7 to 17 then continue to explore how typical methodological issues have been treated in various applications of LCA. These chapters provide the reader with case studies, for example, on modeling the agri-food industry in LCA and related challenges in data collection (chapter 7). Exergetic LCA (Ex-LCA) and its application to an advanced hydrogen process driven by nuclear energy is presented by Rosen, Dincer, and Ozbilen in chapter 8, who highlight differences of Ex-LCA in comparison to traditional LCA impact categories. Following this, Landers, Urban, and Bakshi discuss the integration of ecosystem goods and services, such as fresh water, soil, carbon and nitrogen cycles, and pollination, essential to all human activities, into ecologically based LCA (eco-LCA, chapter 8). Different ecosystem services are compared using exergy and emergy estimates and the authors emphasize the need for including natural capital in the analysis to avoid burden shifting. Other chapters deal, for example, with the application of LCA to waste management (chapter 11), buildings (chapter 14), and green chemistry and engineering (chapter 17). Each chapter is self-contained so readers can skip to topics of greatest interest to them.

Chapters 18 to 22 discuss how LCA supports decision making and sustainability. The chapter by Potting et al (chapter 18) compares four methods that allow assessment of human

health and environmental impacts, namely technology assessment, environmental impact assessment, risk assessment, and LCA. The authors give a brief, yet interesting, overview of their overlaps, differences, and complementary approaches. The use of MCDA to help structure normalization and weighting during the impacts assessment stage of an LCA is introduced by Prado, Rogers, and Seager (chapter 19). This chapter provides a critical discussion of using external normalization and weighting factors in comparative LCAs that may be part of a pre-designed impact assessment method. The next two chapters build nicely on each other by first introducing how social aspects may be integrated into the LCA framework under the umbrella of social LCA (Benoit, chapter 20), and then by discussing the concept of LCSA (Zamagni et al, chapter 21), which aims at broadening the scope of indicators (environmental, social, and economic) and proposes to shift from individual product systems to larger units of measurement (e.g., whole product baskets, economic sectors, or whole economies). Although life cycle cost (LCC) analysis and consequential LCA are mentioned several times in this section of the book (as well as in chapter 1), I felt that a deeper discussion of these topics was missing and would have provided valuable information to allow the reader to better follow the overall discussion. A comprehensive review of consequential LCA is given, e.g., in (Earles and Halog 2011) and LCC is discussed in (Hunkeler et al. 2008). Chapter 22 by Stevenson and Ingwersen provides a review of environmental product claims in LCA according to the ISO 14020 series and includes an appendix that summarizes, amongst others, activities in the development of product category rules (PCRs) and environmental product declarations (EPDs).

Finally, chapters 23 to 25 conclude by looking at the role that life cycle information, in the hands of governments, industry, and consumers, can have in recognizing environmental performance and avoid shifting of environmental burdens. In this context, chapter 23 by

Ramjeawon looks at capacity building for LCA in developing countries, and chapter 25 by Fava discusses real case studies involving use of (or failure to use) life cycle information to elucidate burden shifting. The latter chapter could make a perfect introduction to a class on LCA or life cycle thinking with the aim to capture people's attention and interest to the field.

Overall, this book provides a comprehensive review of the latest advances in the LCA methodology and incorporates perspectives from academics, industry representatives, and LCA practitioners and consultants. I can warmly recommend it for readers with some prior exposure to the LCA methodology.

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