A Life Cycle Analysis Model And Decision Support Tool For

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Life Cycle Assessment of Energy Systems CRC Press
Life cycle assessment (LCA) is an established methodology used to quantify the environmental impacts of products, processes and services. Circular economy (CE) thinking is conceptual way of considering the impacts of consuming resources. By taking a closed loop approach, CE provides a framework for influencing behaviours and practices to minimise this impact. Development of the circular economy is a crucial component in the progression towards future sustainability. This book provides a robust systematic approach to the circular economy concept, using the established methodology of LCA. Including chapters on circular economic thinking, the use of LCA as a metric and linking LCA to the wider circular economy, this book utilises case studies to illustrate the approaches to LCA. With contributions from researchers worldwide, Life Cycle Assessment provides a practical, global guide for those who wish to use LCA as a research tool or to inform policy, process, and product improvement.
Life-Cycle Assessment of Biorefineries Springer Science & Business Media
Life Cycle Assessment
Progress in Life Cycle Assessment Springer Nature
This book presents specialised methods and tools built on classical LCA. In the first book-length overview, their importance for the further growth and application of LCA is demonstrated for some of the most prominent species of this emerging trend: Carbon footprinting; Water footprinting; Eco-efficiency assessment; Resource efficiency assessment; Input-output and hybrid LCA; Material flow analysis; Organizational LCA. Carbon footprinting was a huge driver for the market expansion of simplified LCA. The discussions led to an ample proliferation of different guidelines and standards including ISO/TS 14067 on Carbon Footprint of Product. Atsushi Inaba (Kogakuin University, Tokyo, Japan) and his eight co-authors provide an up-to-date status of Carbon Footprint of Products. The increasing relevance of Water Footprinting and the diverse methods were the drivers to develop the ISO 14046 as international water footprint standard. Markus Berger (Technische Universität Berlin, Germany), Stephan Pfister (ETH Zurich, Switzerland) and Masaharu Motoshita (Agency of Industrial Science and Technology, Tsukuba, Japan) present a status of water resources and demands from a global and regional perspective. A core part is the discussion and comparison of the different water footprint methods, databases and tools. Peter Saling from BASF SE in Ludwigshafen, Germany, broadens the perspective towards Eco-efficiency Assessment. He describes the BASF-specific type of eco-efficiency analysis plus adaptions like the so-called SEEBALANCE and AgBalance applications. Laura Schneider, Vanessa Bach and Matthias Finkbeiner (Technische Universität Berlin, Germany) address multi-dimensional LCA perspectives in the form of Resource Efficiency Assessment. Research needs and proposed methodological developments for abiotic resource efficiency assessment, and especially for the less developed area of biotic resources, are discussed.The fundamentals ofInput-output and Hybrid LCA are covered by Shinichiro Nakamura (Waseda University, Tokyo, Japan) and Keisuke Nansai (National Institute for Environmental Studies, Tsukuba, Japan). The concepts of environmentally extended IO, different types of hybrid IO-LCA and the waste model are introduced. David Laner and Helmut Rechberger (Vienna University of Technology, Austria) present the basic terms and procedures of Material Flow Analysismethodology. The combination of MFA and LCA is discussed as a promising approach for environmental decision support. Julia Martínez-Blanco (Technische Universität Berlin, Germany; now at Inèdit, Barcelona, Spain), Atsushi Inaba (Kogakuin University, Tokyo, Japan) and Matthias Finkbeiner (Technische Universität Berlin, Germany) introduce a recent development which could develop a new trend, namely the LCA of Organizations.
Environmental Life Cycle Assessment of Goods and Services Routledge
This book proposes an economic and environmental assessment tool to help private and public building designers and owners determine the global sustainability value of green buildings from a life cycle perspective. As it demonstrates, sustainable life cycle tools for building design and construction can help to achieve successfully integrated architecture. The first part of the book defines the relationship between environmental and economic aspects in a sustainable design approach and illustrates how life cycle methodologies, including Life Cycle Assessment and Life Cycle Costing, can be applied to life cycle design. Further, it highlights methods for calculating costs from LCA data, taking into consideration both discounted cash flow and external costs. In turn, the second part of the book presents an experimental design model, the Life Cycle Design Model (LCDM), which is based on a life cycle design approach that can be used to produce two different outcomes based on two assessment levels. The first assessment level involves creating a grid, called a Design Matrix, which is useful in the design process. The second assessment level involves drawing on LCA and LCC results to develop a user-friendly tool for designers and other actors

involved in the building process so that they can assess the most sustainable design option using €CO, a factor that combines the environmental and energy effects of the building system with time and costs. Selected case studies illustrate the practical application of life cycle analysis and show how reflecting the environmental impacts and costs can improve the sustainability of buildings. The LCDM represents a transdisciplinary tool for the design team and, at the same time, allows information on users' needs and building performance to be communicated between experts and non-experts.

Life Cycle Assessment Springer

Life Cycle Sustainability Assessment for Decision-Making: Methodologies and Case Studies gives readers a comprehensive introduction to life cycle sustainability assessment (LCSA) methodology for sustainability measurement of industrial systems, proposing an efficiency methodology for stakeholders and decision-makers. Featuring the latest methods and case studies, the book will assist researchers in environmental sciences and energy to develop the best methods for LCA, as well as aiding those practitioners who are responsible for making decisions for promoting sustainable development. The past, current status and future of LCSA, Life Cycle Assessment method (LCA), Life Cycle Costing (LCC), Social Life Cycle Assessment (SLCA), the methodology of LCSA, typical LCSA case studies, limitations of LCSA, and life cycle aggregated sustainability index methods are all covered in this multidisciplinary book. Includes models for assessing sustainability in environmental, energy engineering and economic scenarios Features case studies that help define the advantages and obstacles of real world applications Presents a complete view, from theory to practice, of a life cycle approach by exploring the methods and tools of sustainability assessment, analysis and design of sustainability assessment

Life Cycle Assessment for Sustainable Mining Royal Society of Chemistry

This first hands-on guide to ISO-compliant Life Cycle Assessment (LCA) makes this powerful tool immediately accessible to both professionals and students. Following a general introduction on the philosophy and purpose of LCA, the reader is taken through all the stages of a complete LCA analysis, with each step exemplified by real-life data from a major LCA project on beverage packaging. Measures as carbon and water footprint, based on the most recent international standards and definitions, are addressed. Written by two pioneers of LCA, this practical volume is targeted at first-time LCA users but equally makes a much-valued reference for more experienced practitioners. From the content: * Goal and Scope Definition * Life Cycle Inventory Analysis * Life Cycle Impact Assessment * Interpretation, Reporting and Critical Review * From LCA to Sustainability Assessment and more.

Life Cycle Assessment Springer

Planet Earth is under stress from various environmental factors, increasing the importance of being able to estimate the environmental costs associated with dynamic material shifts. Such shifts are occurring in the electronics industry and the most famous recent example is the introduction of lead-free solders. "Global Life Cycle Impact Assessments of Material Shifts" describes the environmental implications of this shift to lead-free solders and conductive adhesives using the standardized methodology of environmental life-cycle assessment (LCA). As the product systems involved are rather small for interconnection materials it is possible – using uncertainty analysis and consequential LCA – to arrive at robust conclusions, even in the difficult holistic field of environmental cost accounting. The lead-free shift has many implications, such as the export of electronics waste, resource consumption, recycling issues, and technology development.

Life Cycle Management Springer Nature

This book is a uniquely pedagogical while still comprehensive state-of-the-art description of LCA-methodology and its broad range of applications. The five parts of the book conveniently provide: I) the history and context of Life Cycle Assessment (LCA) with its central role as quantitative and scientifically-based tool supporting society's transitioning towards a sustainable economy; II) all there is to know about LCA methodology illustrated by a red-thread example which evolves as the reader advances; III) a wealth of information on a broad range of LCA applications with dedicated chapters on policy development, prospective LCA, life cycle management, waste, energy, construction and building, nanotechnology, agrifood, transport, and LCA-related concepts such as footprinting, ecolabelling,design for environment, and cradle to cradle. IV) A cookbook giving the reader recipes for all the concrete actions needed to perform an LCA. V) An appendix with an LCA report template, a full example LCA report serving as inspiration for students who write their first LCA report, and a more detailed overview of existing LCIA methods and their similarities and differences.

Background and Future Prospects in Life Cycle Assessment Elsevier

Tourism is an activity that anyone can take part in, regardless of their age, gender, nationality or level of income. This makes tourism one of the most rapidly developing industries in the world. Despite the number of benefits which tourism produces, it also has significant negative impacts on the environment. To minimise the scope of these negative impacts, joint efforts combining tourism and environmental management are called for. This book examines the application of the Life Cycle Assessment (LCA) method and lifecycle thinking as a tool to generate more accurate and holistic appraisals of the environmental impacts of tourism. Looking at the issue of sustainability of tourism operations, the book evaluates how it can be improved. It highlights the potential of LCA to affect tourist behaviour and contribute to tourism policy-making and managerial practice. This book provides a valuable resource for undergraduates, postgraduates and researchers interested in sustainable tourism, sustainable development and environmental impact assessment.

Global Life Cycle Impact Assessments of Material Shifts Springer Science & Business Media

This open access book provides insight into the implementation of Life Cycle approaches along the entire business value chain, supporting environmental, social and economic sustainability related to the development of industrial technologies, products, services and policies; and the development and management of smart agricultural systems, smart mobility systems, urban infrastructures and energy for the built environment. The book is based on papers presented at the 8th International Life Cycle Management Conference that took place from September 3-6, 2017 in Luxembourg, and which was organized by the Luxembourg Institute of Science and Technology (LIST) and the University of Luxembourg in the framework of the LCM Conference Series.

The Computational Structure of Life Cycle Assessment Routledge

Environmental Life Cycle Assessment is a pivotal guide to identifying environmental problems and reducing related impacts for companies and organizations in need of life cycle assessment (LCA).

LCA, a unique sustainability tool, provides a framework that addresses a growing demand for practical technological solutions. Detailing each phase of the LCA methodology, this textbook covers the historical development of LCA, presents the general principles and characteristics of LCA, and outlines the corresponding standards for good practice determined by the International Organization for Standardization. It also explains how to identify the critical aspects of an LCA, provides detailed examples of LCA analysis and applications, and includes illustrated problems and solutions with concrete examples from water management, electronics, packaging, automotive, and other industries. In addition, readers will learn how to: Use consistent criteria to realize and evaluate an LCA independently of individual interests Understand the LCA methodology and become familiar with existing databases and methods based on the latest results of international research Analyze and critique a completed LCA Apply LCA methodology to simple case studies Geared toward graduate and undergraduate students studying environmental science and industrial ecology, as well as practicing environmental engineers, and sustainability professionals who want to teach themselves LCA good practices, Environmental Life Cycle Assessment demonstrates how to conduct environmental assessments for products throughout their life cycles. It presents existing methods and recent developments in the growing field of LCA and systematically covers goal and system definition, life cycle inventory, life cycle impact assessment, and interpretation.

Life Cycle Design Elsevier

Industrial ecology is a concept that has emerged in response to growing public concern about the impact of industry on the environment. In this framework the natural flow (or circulation) of materials and energy that takes place in biological ecosystems becomes a model for more efficient industrial "metabolism." What industrial ecology is and how it may be applied to corporate environmentalism are the subject of The Industrial Green Game. This volume examines industrial circulation of materials, energy efficiency strategies, "green" accounting, life-cycle analysis, and other approaches for preventing pollution and improving performance. Corporate leaders report firsthand on "green" efforts at Ciba-Geigy, Volvo, Kennecott, and Norsk Hydro. And an update is provided on the award-winning industrial symbiosis project in Kalundborg, Denmark. The Industrial Green Game looks at issues of special concern to business, such as measuring and shaping public perceptions and marketing "green" products to consumers. It offers discussions of the appropriate roles of government and private business.

Reliability and Life-Cycle Analysis of Deteriorating Systems CRC Press

Life cycle assessment (LCA) is internationally accepted as a core topic in the field of environmental management in various industries for obtaining a complete picture of the environmental impacts of products or processes. In contrast to other types of environmental management tools or sustainability assessment methods, LCA methodologies take a holistic approach to include all relevant processes starting from the extraction of natural resources to various manufacturing stages that lead to the final product.Following an evidence-approach, LCA is underpinned by quantitative methodologies to study real-world problems and uncover 'hidden' impacts beyond the conventional boundary of a single-stage manufacturing system, to develop sustainable strategies that consider regional or global production chains.This book offers multi-disciplinary perspectives of new LCA developments and applications, spanning from data variability to ecosystem services, plus the evaluation of the net greenhouse gas from Carbon Capture and Utilization (CCU) methods and waste management. Perspectives of green chemistry principles via LCA, combined with life cycle atom economy approaches are explored. Industrial symbiosis concepts, LCA as an Entrepreneurial Tool for Business Management and Green Innovations, and blockchain-enabled LCA are also presented.

Perspectives in Life Cycle Impact Assessment Springer

This book describes the importance of the goal and scope phase for the entire LCA study. In this first phase of the LCA framework (ISO standardized), the purpose of the assessment is defined and decisions are made about the details of the industrial system being studied and how the study will be conducted. Selecting impact categories, category indicators, characterization models, and peer review is decided during goal and scope definition. The book provides practical guidance and an overview of LCIA methods available in LCA software. Although not specified in the ISO standards, Attributional LCA and Consequential LCA are presented in order to appropriately determine the goal and scope of an assessment. The book closes with the interconnection between goal and scope definition and the interpretation phase. Example goal and scope documents for attributional and consequential LCAs are provided in the annexes.

The Industrial Green Game National Academies Press

Investigative tools for analyzing environmental nanoparticles with health impactsBasic theories and models of life cycle analysis applied to nanomaterialsConnects LCA, detection technologies and sustainability This book addresses the ways life cycle assessment (LCA) concepts can be applied to analyze the fate of nanoparticles in a variety of environmental and manufacturing settings. After introducing LCA theory and modeling concepts, the work discusses risks associated with carbon nanotubes, graphene, silver, fullerenes, iron oxides and other particles generated by manufacturing or medical diagnostics. Chapters in the text discuss biomolecules and the application of in vivo biosensors. Also covered are fate analysis, risk assessment, toxicology and nanopathology with a focus on human health and disease.

Life Cycle Sustainability Assessment (LCSA) Springer

The trend in industry and with the EPA is to prevent wastes before they are created instead of treating or disposing of them later. This book assists design/systems engineers and managers in designing or changing a product or set of processes in order to minimize the negative impact on the environment during its life cycle. It explains the overall concept of environmental life cycle analysis and breaks down each of the stages, providing a clear picture of the issues involved. Chapters 1 and 2 provide an introduction and overview of the environmental life cycle analysis process. Chapter 3 establishes the basis and methodologies required for analysis through description of the basic framework, definition of boundaries, use of checklists, data gathering processes, construction of models, and interpretation of results. Templates and special cases that may be encountered and how to handle them are addressed in Chapter 4. Chapters 5 through 9 go into detail about modeling, issues, and data collection for each stage of the product life cycle. The final chapter provides a summary of the various steps and offers ideas on how to present data and reports.

Life Cycle Assessment Routledge

Environmental Life Cycle Assessment (ELCA) that was developed about three decades ago demands a broadening of its scope to include lifecycle costing and social aspects of life cycle assessment as

well, drawing on the three-pillar or ‘triple bottom line’ model of sustainability, which is the result of the development of the Life Cycle Sustainability Assessment (LCSA). LCSA refers to the evaluation of all environmental, social and economic negative impacts and benefits in decision-making processes towards more sustainable products throughout their life cycle. Combination of environmental and social life cycle assessments along with life cycle costing leads to life cycle sustainability assessment (LCSA). This book highlights various aspects of life cycle sustainability assessment (LCSA).

Goal and Scope Definition in Life Cycle Assessment Springer

The purpose of this book is to collect a high-quality selection of contemporary research articles on life cycle perspectives when we want to assess and predict the sustainability of solutions that lie in front of us.The book focuses on methodologies and tools used for life cycle sustainability management covering environmental, social, and economic aspects in business practices, including modeling and simulation-based approaches. In particular, the book aims to collect research, applications, and case studies in the field of environmental analysis and industrial ecology, with a focus on how to assess contributions to increase resource efficiency and reduce environmental impact on production and service systems in a life cycle perspective (raw material extraction, production, use, and end-of-life management).This book is intended to be a useful resource for anyone who deals with this issue.

Environmental Life Cycle Assessment of Goods and Services Routledge

Life-Cycle Assessment of Biorefineries, the sixth and last book in the series on biomass-biorefineries discusses the unprecedented growth and development in the emerging concept of a global bio-based economy in which biomass-based biorefineries have attained center stage for the production of fuels and chemicals. It is envisaged that by 2020 a majority of chemicals currently being produced through a chemical route will be produced via a bio-based route. Agro-industrial residues, municipal solid wastes, and forestry wastes have been considered as the most significant feedstocks for such bio-refineries. However, for the techno-economic success of such biorefineries, it is of prime and utmost importance to understand their lifecycle assessment for various aspects. Provides state-of-art information on the basics and fundamental principles of LCA for biorefineries Contains key features for the education and understanding of integrated biorefineries Presents models that are used to cope with land-use changes and their effects on biorefineries Includes relevant case studies that illustrate main points

Environmental Life Cycle Analysis Springer

Energy and sustainability are two of the most important and often most misunderstood subjects in our world today. As these two subjects have grown in importance over the last few decades, interest in the Life Cycle Assessment (LCA) model has grown as well, as a potentially crucial tool in understanding and striving towards sustainability in energy systems. Not just wind and solar systems, but all energy systems, need to be understood through this model. Wind and solar power have the potential to decentralize the U.S. energy system by offering local communities electricity and economic support, depending on the scale and design of projects. Nevertheless, every energy technology potentially faces environmental costs, lay and expert opposition, and risks to public health. Engineers play a central role as designers, builders, and operators in energy systems. As they extend their expertise into electrical, mechanical and chemical fields, from fossil fuel-based systems to renewable energy systems, “sustainability” is steadily becoming one of the key criteria engineers apply in their work. This groundbreaking new study argues that engineering cultures foster sustainability by adopting assumptions and problem-solving practices as part of their identities when designing and building engineering projects. This work examines the politics of creating, utilizing, and modifying Life Cycle Assessment (LCA) in the construction of renewable energy systems. The only volume of its kind ever written, it is a must-have for any engineer, scientist, manager, or other professional working in or interested in Life Cycle Assessment and its relation to energy systems and impact on environmental and economic sustainability.