

## User Interface

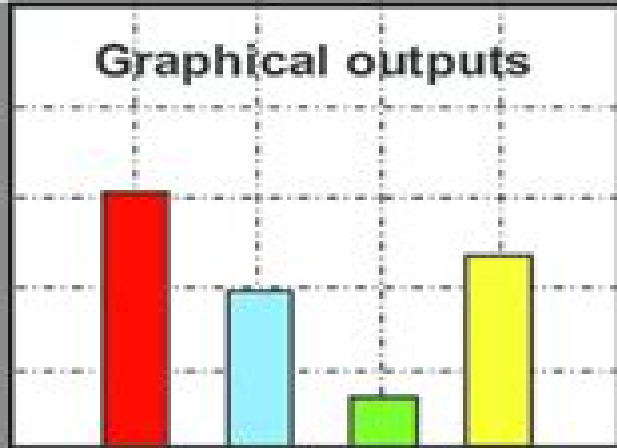
- Bill of materials
- Production processes
- Transport requirements
- Product duty cycle
- etc...

## Eco database

- Embodied energies
- Associated CO<sub>2</sub> footprints
- Processing energies
- Unit transportation energies

## Eco audit model

## Graphical outputs



## Tabular data

- Life-phase energy
- Data used
- Calculation steps

## DfEM decision making

# Streamlined Life Cycle Assessment

**Judd E. Hollander**



## **Streamlined Life Cycle Assessment:**

**Development of Metrics for Streamlined Life Cycle Assessments** Maria de Lourdes Alcaraz Ochoa, 2016 Growing concern about climate change and human impact on the environment have resulted in an increase in interest for evaluating the environmental impact of products and services we consume Life cycle assessment LCA has become the most prominent method for environmental evaluation Life cycle assessment is the quantification of the environmental impacts of a product or service through its whole life cycle from the extraction of materials to manufacturing and end of life A carbon footprint is a subset of an LCA LCAs are required as part of government regulations used by companies to identify high resource use in their supply chain or to choose between product designs and by consumers to choose between alternative product choices LCAs provide valuable information however they are resource intensive time consuming and uncertain Therefore a methodology that addresses all these issues is needed This study addresses the following question Can LCAs be streamlined while still providing useful information To answer this an under specification probabilistic screening methodology is employed The screening methodology uses a high level assessment of the footprint incorporates uncertainty in the inputs and refines data around the primary drivers of impact The streamlined LCA procedure is extended to include a Sobol based sensitivity analysis methodology for identifying high impact activities The effects of partial perfect information in subsequent data acquisition activities on the streamlining methodology are examined Metrics to determine sufficiency in the data gathering procedure and to determine whether decision makers can sufficiently distinguish between two products or design alternatives are developed A procedure to quantify the cost of additional information is developed Finally an exploration of the scenario space of the impacts is analyzed The extended streamlined methodology is applied to a case study on tablets with a focus on integrated circuits This thesis finds that the streamlined probabilistic methodology can be used to cost effectively evaluate the environmental impact of products while still taking uncertainty into account Metrics to determine sufficiency can be effectively used and the presence of partial information does not limit the usefulness of the metrics Furthermore quantifying the cost of additional information can help determine sufficiency in data collection efforts and can help understand the challenges that companies face when performing an LCA *Streamlined Life-cycle Assessment* T. E. Graedel, 1998 This book examines the question of what makes one design environmentally preferable to another Graedel discusses data and analyzes the streamlined life cycle assessment process in the context of the goals of a particular process or product FEATURES Discusses environmental objectives as the basis of life cycle assessment Focuses on streamlined LCAs a technique common in industry today Includes unique coverage of the assessment of societal infrastructures Ch 12 Ends with a hypothetical discussion of what an environmentally perfect product might look like Includes useful checklists for performing SLCA **Life Cycle Assessment in the Built Environment** Robert Crawford, 2011-03-10 Life cycle assessment enables the identification of a broad range of potential environmental impacts occurring across the entire life of a

product from its design through to its eventual disposal or reuse The need for life cycle assessment to inform environmental design within the built environment is critical due to the complex range of materials and processes required to construct and manage our buildings and infrastructure systems After outlining the framework for life cycle assessment this book uses a range of case studies to demonstrate the innovative input output based hybrid approach for compiling a life cycle inventory This approach enables a comprehensive analysis of a broad range of resource requirements and environmental outputs so that the potential environmental impacts of a building or infrastructure system can be ascertained These case studies cover a range of elements that are part of the built environment including a residential building a commercial office building and a wind turbine as well as individual building components such as a residential scale photovoltaic system Comprehensively introducing and demonstrating the uses and benefits of life cycle assessment for built environment projects this book will show you how to assess the environmental performance of your clients projects to compare design options across their entire life and to identify opportunities for improving environmental performance

*Life Cycle Assessment* Ralph Horne, Tim Grant, Karli Verghese, 2009 Life Cycle Assessment LCA has developed in Australia over the past 16 years in a fragmented way with many different people and organizations contributing to the area at different times and largely through informal or unpublished work This publication will legitimize and document LCA research and methodology development to act as a record of what has happened and a basis for future development and application of the tool The Centre for Design at RMIT has been a leading research center in Australia through its work on data collection methodology development and contribution to knowledge through undertaking LCA studies for leading companies and government departments ranging from products packaging buildings water management and waste management This work in addition to key work undertaken by other researchers will be presented The book will become a bridge between LCA implementation and life cycle management LCM and provide discussion on how LCA development will be in the future and how it integrates with available software tools

**Sustainability and Life Cycle Assessment in Industrial Biotechnology** Magnus Fröhling, Michael Hiete, 2020-06-16 This book reviews the assessment of industrial biotechnology products and processes from a sustainable perspective Industrial Biotechnology is a comparably young field which comes along with high expectations with regard to sustainability issues These stem from the promise of reducing greenhouse gas emissions and replacing fossil resources in the near or later future and using green technology i e more environmentally friendly technologies The intended economic ecological and social benefits however need to be proven resulting in a variety of challenges both from a methodological and application point of view In this book specific assessment and application topics of industrial biotechnology are addressed highlighting challenges and solutions for both developers and users of assessment methods In twelve chapters experts in their particular fields define the scope characterize industrial biotechnology and show in their contributions the state of the art challenges and prospects of assessing industrial biotechnology products and processes The chapter Societal and Ethical

Aspects of Industrial Biotechnology of this book is available open access under a CC BY 4.0 license at [link.springer.com](http://link.springer.com)

**Life Cycle Assessment** Michael Z. Hauschild, Ralph K. Rosenbaum, Stig Irving Olsen, 2017-09-01 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

**Life Cycle Assessment Student Handbook** Mary Ann Curran, 2015-07-10 This student version of the popular bestseller Life Cycle Assessment Handbook is not a watered down version of the original but retains all of the important information and valuable lessons provided in the first book along with helpful problems and solutions for the student learning about Life Cycle Assessment LCA. As the last several decades have seen a dramatic rise in the application of LCA in decision making the interest in the life cycle concept as an environmental management and sustainability tool continues to grow. The LCA Student Handbook offers a look at the role that life cycle information in the hands of companies governments and consumers may have in improving the environmental performance of products and technologies. It concisely and clearly presents the various aspects of LCA in order to help the reader better understand the subject. The international success of the sustainability paradigm needs the participation of many stakeholders including citizens corporations academia and NGOs. The handbook links LCA and responsible decision making and how the life cycle concept is a critical element in environmental sustainability. It covers issues such as building capacity in developing countries and emerging economies so that they are more capable of harnessing the potential in LCA for sustainable development. Governments play a very important role with the leverage they have through procurement regulation international treaties tax incentives public outreach and other policy tools. This compilation of points to the clear trend for incorporating life cycle information into the design and development processes for products and policies just as quality and safety concerns are now addressed throughout product design and development. The Life Cycle Assessment Student Handbook is not just for students. It is also a valuable resource for practitioners looking for a desktop reference on LCA or for any engineer manager or policy maker wishing to learn about LCA.

**The Use of Life Cycle Assessment in Environmental Labelling Programs** Gary Allen Davis, 1993 This report documents the methodologies used by independent third party environmental labelling programs for

the development of criteria for certification of products for environmental labelling In particular the project investigated the extent to which life cycle assessment LCA methodologies are being used in environmental labelling programs worldwide The report also describes alternative methodologies that are being used or that could potentially be used for environmental labelling

**Background and Future Prospects in Life Cycle Assessment** Walter Klöpffer,2014-03-20 Life Cycle Assessment LCA has become the recognized instrument to assess the ecological burdens and human health impacts connected with the complete life cycle creation use end of life of products processes and activities enabling the assessor to model the entire system from which products are derived or in which processes and activities operate This volume introduces the major new book series LCA Compendium The Complete World of Life Cycle Assessment In this volume the main drivers in the development of LCA are explored The volume also discusses strengths and limitations in LCA as well as challenges and gaps thus offering an unbiased picture of the state of the art and future of LCA

**Handbook on Life Cycle Assessment** Jeroen B. Guinée,2006-04-11 Environmental policy aims at the transition to sustainable production and consumption This is taking place in different ways and at different levels In cases where businesses are continuously active to improve the environmental performance of their products and activities the availability of knowledge on environmental impacts is indispensable The integrated assessment of all environmental impacts from cradle to grave is the basis for many decisions relating to achieving improved products and services The assessment tool most widely used for this is the environmental Life Cycle Assessment or LCA Before you is the new Handbook of LCA replacing the previous edition of 1992 New developments in LCA methodology from all over the world have been discussed and where possible included in this new Handbook Integration of all developments into a new consistent method has been the main aim for the new Handbook The thinking on environment and sustainability is however quickly evolving so that it is already clear now that this new LCA Handbook does not embrace the very latest developments Therefore further revisions will have to take place in the future A major advantage of this Handbook is that it now also advises which procedures should be followed to achieve adequate relevant and accepted results Furthermore the distinction between detailed and simplified LCA makes this Handbook more broadly applicable while guidance is provided as to which additional information can be relevant for specialised applications

**Comparison of energy efficient and green buildings** Shrestha, Shritu,2016-04-18 The adverse environmental impacts from inefficient building construction increase if measures to reduce energy and resource use through stringent building policies and efficient technology are not implemented in developed and developing countries To illustrate a holistic approach to reducing buildings energy and resources the comparison of energy efficient and green buildings in terms of their technological aspects and their policy context in developed and developing countries mainly in Europe the USA and India is presented together with a policy package recommendation for Nepal A quality review of multiple literature sources supported by various expert opinions were the methods used for this in depth analysis It discusses that mandatory building standards voluntary labels

information instruments and financial incentives are the most effective combination for the shift towards market transformation that results in a higher share of energy efficient and green buildings. The lesson such as higher compliance with and enforcement of building energy standards can be seen in developed countries e.g. Germany. Looking at a building's life cycle perspective it is not sufficient to focus solely on operational energy reduction in higher energy efficient buildings as this is achieved by the increased use of energy intensive materials. Green requirements must be considered in updating building energy standards and labels particularly for developed countries. Green building certification will also become more effective when the stringency of energy standards is higher and when the whole building life cycle assessment is considered. Due to the increasing scarcity of energy and resources many developing countries are forced to face up to the need for holistic green buildings. Although baseline standards are not as high as in most developed countries and national financial support is low the gradual move towards making the standards more stringent and incorporating the wider scope of resource saving are positive developments in developing countries e.g. India. However to achieve significant success strategies must include the establishment of a suitable funding environment, a political commitment and a strong government vision for long term and sustainable building construction. The challenges faced by Nepal are even greater due to the fast pace of urban growth and the absence of energy and resource efficient buildings policies highlighting the need for an effective policy package. Overall this dissertation demonstrates how energy efficient and green buildings are interlinked. Green buildings reinforced with higher levels of energy efficiency and energy efficient buildings incorporating green requirements are stepping stones for achieving greater building energy and resource efficiencies. And a suitable policy package fosters its development.   
Nachteilige Umweltwirkungen eines ineffizienten Bausektors nehmen zu wenn Maßnahmen zur Reduktion des Energie und Ressourcenbedarfs in Form stringenter Gebäudepolitiken und effizienter Technologie in Industrieländern und Entwicklungsländern nicht umgesetzt werden. Um einen ganzheitlichen Ansatz zur Reduktion des Energie und Ressourcenbedarfs von Gebäuden abzubilden werden energieeffiziente und grüne Gebäude hinsichtlich technologischer Aspekte und ihres Politikkontextes in Industrie und Entwicklungsländern verglichen. Die Analysen beziehen sich hauptsächlich auf Europa, die USA und Indien und werden ergänzt um Empfehlungen für ein Maßnahmenpaket für Nepal. Ein Review unterschiedlicher Literaturquellen unterstützt durch diverse Expertenmeinungen stellt die methodische Grundlage für diese detaillierte Analyse dar. Es diskutiert dass Bauvorschriften und standards, freiwillige Label, Informationsinstrumente und finanzielle Anreize bilden die effektivste Kombination für die Einleitung einer Markttransformation die schließlich zu einem höheren Anteil energieeffizienter und grüner Gebäude führt. Gute Beispiele einer höheren Beachtung von Gebäudeenergiestandards und deren Weiterentwicklung existieren in verschiedenen Industrieländern wie Deutschland. Unter Berücksichtigung des Lebenszyklus von Gebäuden ist es nicht ausreichend nur die Reduktion des Energieverbrauchs in der Nutzungsphase der Gebäude zu beachten weil diese den Einsatz von Materialien mit hohem Energieverbrauch in der

Herstellung bedeuten kann. Größere Anforderungen müssen in der zukünftigen Entwicklung von Gebäudeenergiestandards und Labels berücksichtigt werden, insbesondere in Industrieländern. Die Zertifizierung grüner Gebäude wird auch effektiver werden, wenn Energiestandards verschärft werden und wenn vollständige Gebäudebilanzen berücksichtigt werden. Aufgrund steigender Knappheit von Energie und Ressourcen sind viele Entwicklungsländer gezwungen, sich der Notwendigkeit grüner Gebäude zu stellen. Obwohl das Niveau von Mindeststandards unterhalb dessen der meisten entwickelten Länder liegt und die finanzielle Unterstützung gering ist, sind die schrittweise Verschärfung der Standards und die Einbeziehung der weiteren Perspektive der Ressourcenschonung positive Entwicklungen in Entwicklungsländern wie Indien. Um erfolgreich zu sein, müssen bestehende Strategien umfasst werden, an die Schaffung eines geeigneten Rahmens, die politische Bekenntnis und eine starke Regierungsvision für einen langfristigen und nachhaltigen Bausektor. Die Herausforderungen, mit denen Nepal konfrontiert wird, sind noch umfangreicher. Sie resultieren aus einem schnellen urbanen Wachstum und dem Fehlen von energie- und ressourceneffizienten Gebäudepolitiken. Die Erforderlichkeit eines effektiven Maßnahmenpakets für Nepal wird hierdurch unterstrichen. Insgesamt wird hierdurch der Zusammenhang zwischen energieeffizienten und grünen Gebäuden aufgezeigt. Die verstärkte Berücksichtigung von Energieeffizienz in grünen Gebäuden sowie von Nachhaltigkeitsanforderungen in energieeffizienten Gebäuden sind Sprungbretter für die verbesserte Energie- und Ressourceneffizienz von Gebäuden. Eine solche Entwicklung wird durch ein geeignetes Maßnahmenpaket unterstützt.

Life Cycle Assessment of Renewable Energy Sources Anoop Singh, Deepak Pant, Stig Irving Olsen, 2013-09-02 Governments are setting challenging targets to increase the production of energy and transport fuel from sustainable sources. The emphasis is increasingly on renewable sources including wind, solar, geothermal, biomass based biofuel, photovoltaics or energy recovery from waste. What are the environmental consequences of adopting these other sources? How do these various sources compare to each other? Life Cycle Assessment of Renewable Energy Sources tries to answer these questions based on the universally adopted method of Life Cycle Assessment (LCA). This book introduces the concept and importance of LCA in the framework of renewable energy sources and discusses the key issues in conducting their LCA. This is followed by an in-depth discussion of LCA for some of the most common bioenergy sources such as agricultural production systems for biogas and bioethanol, biogas from grass, biodiesel from palm oil, biodiesel from used cooking oil and animal fat, Jatropha biodiesel, lignocellulosic bioethanol, ethanol from cassava and sugarcane molasses, residential photovoltaic systems, wind energy, microalgal biodiesel, biohydrogen and biomethane. Through real examples, the versatility of LCA is well emphasized. Written by experts all over the globe, the book is a cornucopia of information on LCA of bioenergy systems and provides a platform for stimulation of new ideas and thoughts. The book is targeted at practitioners of LCA and will become a useful tool for researchers working on different aspects of bioenergy.

Life Cycle Assessment in Aviation T. Hikmet Karakoc, Selçuk Ekici, Alper Dalkiran, 2024-03-19 Life Cycle Assessment in Aviation: Theory and Applications provides readers with a comprehensive analysis that examines various



elements within the aviation sector including aircraft operations maintenance and repair activities aircraft gas turbine engine processes airport auxiliary vehicles airport operations airport construction airport access traffic and airport wastes The book's content has been meticulously crafted to address the specific needs and interests of a diverse audience encompassing researchers engineering students and civil aviation organization officials Readers will find valuable insights and up to date information about the latest developments in the aviation field serving as a valuable resource for their investigations and studies

**Sustainable Development Goals and Sustainable Supply Chains in the Post-global Economy** Natalia Yakovleva, Regina Frei, Sudhir Rama Murthy, 2019-05-21 This book presents a collection of studies on current best practices for delivering sustainable development policies within supply chains It critiques the limitations of existing business theory and practice on sustainable supply chain management and discusses opportunities for new conceptual models for businesses to engage with Sustainable Development Goals SDGs It examines how businesses can work towards implementing Sustainable Development Goals in the contexts of entrepreneurial initiative industry collaboration and regional development SDGs renew the sustainable development agenda for global communities and ask businesses and organisations to reset their sustainable development policies A strategy to embed sustainable development principles into business operations along the supply chain operations which has been a conceptual and in many instances practitioner business and industry achievement of the past decades is not enough to shift the economic and social conditions of poor populations around the world How would the global supply chains of the future look like What social relations does it envisage How will businesses and organisations engage with societies environments and complex institutional contexts in emerging markets and developing countries which are faced with issues of population growth needed leaps in infrastructure provision educational and health improvements cultural and institutional shifts The book challenges current approaches to sustainable supply chain practices guided by discussion on SDGs It reviews implementation issues of existing sustainable development approaches assesses the advancement of sustainable development strategies and examines the opportunities for global value chains to increase their positive social and environmental inputs in regions communities and organisations The book collects both conceptual and empirical studies set in a variety of business and organisational contexts such as manufacturing retail procurement cities and industrial parks It contests the accepted axioms of sustainable practices in the global supply chains and proposes new models for organisations and production networks to engage with societies and address market and production effects on communities and institutions

**Probability, Statistics and Life Cycle Assessment** Reinout Heijungs, 2024-05-20 This textbook discusses the use of uncertainty analysis and sensitivity analysis in environmental life cycle assessment LCA This is a topic which has received a lot of attention by journals including the leading Springer International Journal of Life Cycle Assessment Despite its importance no coherent textbook exists that summarizes the progress that has been made in the last 20 years This book attempts to fill that gap Its audience is practitioners professional and academic of LCA teachers and Ph D

students It gives a very broad overview of the field probability theory descriptive statistics inferential statistics error analysis sensitivity analysis decision theory etc all in relation to LCA Much effort has been taken to give a balanced overview with a uniform terminology and mathematical notation

### **Life Cycle Assessment in Industry and Business** Paolo

Frankl, Frieder Rubik, 2013-03-14 1 1 Life Cycle Assessment LeA a fascinating and sophisticated tool The greening of the economy is not a new task but it is a challenge for which a lot of tasks still have to be done It is known that the main source of environmental deterioration by industry is not any more the chimneys and other process related emissions but the products and services produced Products are regarded as carriers of pollution they are not only a potential source of pollution and waste during their use they are also a cause of resource depletion energy consumption and emissions during their life starting with the extraction of the raw materials and ending with their disposal i.e. connecting production and consumption stages The challenge of these decades is now the greening of products and services The new focus on products

cp Oosterhuis Rubik Schol 1996 was introduced as a policy approach of shared responsibility in which different actors are involved along the life cycle of a product each having specific responsibilities

### **Sustainable Solid Waste Management**

Ni-Bin Chang, Ana Pires, 2015-03-16 This book presents the application of system analysis techniques with case studies to help readers learn how the techniques can be applied how the problems are solved and which sustainable management strategies can be reached

### **Human and Ecological Risk Assessment**

Dennis J. Paustenbach, 2017-05-22 Human and Ecological Risk Assessment Theory and Practice assembles the expertise of more than fifty authorities from fifteen different fields forming a comprehensive reference and textbook on risk assessment Containing two dozen case studies of environmental or human health risk assessments the text not only presents the theoretical underpinnings of the discipline but also serves as a complete handbook and how to guide for individuals conducting or interpreting risk assessments In addition more than 4 000 published papers and books in the field are cited Editor Dennis Paustenbach has assembled chapters that present the most current methods for conducting hazard identification dose response and exposure assessment and risk characterization components for risk assessments of any chemical hazard to humans or wildlife fish birds and terrestrials Topics addressed include hazards posed by Air emissions Radiological hazards Contaminated soil and foods Agricultural hazards Occupational hazards Consumer products and water Hazardous waste sites Contaminated air and water The bringing together of so many of the world's authorities on these topics plus the comprehensive nature of the text promises to make Human and Ecological Risk Assessment the text against which others will be measured in the coming years

### **Solid Waste Management and Greenhouse Gases**, 2002

### **Sustainable Resource Management** Juan F.

Velasco-Munoz, Chaudhery Mustansar Hussain, 2021-06-20 Sustainable Resource Management Modern Approaches and Contexts presents the application of the current concept of sustainability to the management of natural resources such as water land minerals and metals using theoretical field knowledge and illustrative real world examples Initially the book

defines sustainability detailing its evolution and how it has been adapted to each of the contexts in which it is used Furthermore sustainability is made up of three main areas of science environmental social and economic which are rarely considered together This book is a complete reference guide to sustainability of natural resources for academics researchers practitioners and postgraduate level students and more As sustainability is an interdisciplinary field linked to most sciences it is also of use to all fields of science that need to maintain sustainable practices and specific details on the methodologies and techniques needed for sustainable resource management Provides an integrated approach for modern tools methodologies and indicators for sustainable resource management Evaluates emerging trends and advanced approaches in sustainable resource management detailing the most up to date research and management considerations Describes advanced sustainable resource management technologies and presents case studies where applicable

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