

Lifetime Engineering of Buildings and Civil Infrastructures (LIFETIME)

WP2. International state-of-the-art and actions for introducing Lifetime principles into practice of all stakeholders

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Presentation outline

- Task 1. Review of the information on international R&D and training actions in Lifetime Engineering
 - Building programs
 - Educational courses
 - Life Cycle Assessment tools
- Task 2. Review of the international state-of-the-art and training actions in Lifetime Environmental Impact Assessment

Task 1. Review of the information on international R&D and training actions in Lifetime Engineering

The term **Lifetime Engineering** is not widely used outside Europe. Similar concepts in the environmental context are:

- Sustainable Buildings
- Green buildings
- Smart Buildings and
- Environmentally conscious Buildings

these are keywords commonly used in USA, Canada, Australia, New Zealand & the rest of Asia.

Meanwhile in spanish speaking countries, terms such as Sustainable Architecture, Ecological Architecture, Bioclimatic Architecture, Organic Architecture & Eco construction; are preferred

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Sustainable Building programs in USA

Green Building Guidelines from the Sustainable Buildings Industry Council, in cooperation with the National Association of Home Builders

The **U.S. Green Building Council** nonprofit coalition of 1,500 leading companies, organizations, and federal/state/local agencies

Members have developed the LEED™ rating system and third-party certification system for new commercial and high-rise residential buildings. New products are also being developed for the existing commercial market, retail stores, spec developers, schools, and other markets. USGBC also offers LEED training workshops and accreditation.

California Green Builder Program

Green Built Home™, State of Wisconsin

Governor's Green Government Council, Pennsylvania

Built Green Colorado

Green Building Design and Construction, California Int. Waste Management Board

Florida Green Building Coalition Green Home Designation Standard

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Sustainable Building programs in USA

New Jersey Green Homes Office

Hawaii BuiltGreen™

Seattle Sustainable Building, City of Seattle, Washington

Build a Better Kitsap, Washington

Built Green, Washington

Green Building, City of San Jose, California

Green Points Building Program Boulder, Colorado

City of Austin Green Building Program

City of Portland's Green Building Program

EarthCraft House Program, Georgia

Maryland Green Building Program

Green Building Tax Credit on commercial construction, Maryland

Scottsdale Green Building Program, Arizona

Marin's BEST! (Building Energy Efficient Structures Today), Marin County

Build a Better Clark

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Sustainable Building programs in USA

Characteristics

- Available supporting programmes at various government levels (country, state, city, county) some in collaboration with building associations
- Variable (disparate) standards, guidelines, databases and toolkits made available for building rating and certification
- Large number of voluntary programmes
- Cover new projects as well as remodelling projects
- Most programs are voluntary
- Marketing advantage is considered a strong driver by participating building contractors
- Tax credits used as an instrument in few occasions
- Mortgage programmes to encourage customers

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Sustainable Building programs in USA

Green Buildings Energy Rating Systems

- The LEED rating system
- Home Energy Rating Systems (HERS) Programs
- Energy Efficient Mortgage (EEM) Programs
- The Location Efficient Mortgage (LEM)

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Sustainable Building programs in the rest of the world

Canada

Sustainable Buildings, The Canadian Wood Council

This program promotes the Canadian manufacturers of wood products used in construction.

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Sustainable Building programs in the rest of the world

Hong Kong, China

Sustainable Buildings & Construction, The Business Environmental council

This program aims to conduct green building assessment for owners of major commercial and residential buildings in Hong Kong. They use the Hong Kong Building Environmental Assessment Method (HK-BEAM) that defines over 200 best practice criteria over the "life-cycle" of a building.

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Sustainable Building programs in the rest of the world

Japan

Sustainable Building and Construction. United Nation Environmental Program - International Environmental Technology Centre.

This program looks at appropriate tools and concepts for the design and assessment of the sustainability impacts of materials, components and technologies used in buildings and their construction, in developing countries.

Research on Sustainable Buildings. Environmental Research Section of the Advance Research Institute for Science and Engineering.

The objectives of this research is to pursue the way of sustainable buildings from both points of long life of buildings and service systems and a reduction in energy for maintenance and operation.

The 7th Housing Construction Five-Year Program

Japanese Government acting on Agenda21- Social aspect of sustainable development.

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Sustainable Building programs in the rest of the world

Australia

The Australian Building Greenhouse Rating Scheme. Australian Government.

Voluntary program for office buildings, designed to enable building owners, managers and tenants to get market recognition for superior greenhouse performance.

Your Home: Design for Lifestyle and Future. Institute for Sustainable Futures of the University of Sydney and the Australian Greenhouse Office.

This program generated a national guide to design and construct sustainable buildings.

Sustainable Buildings. Centre for Design at the Royal Melbourne Institute of Technology University.

EQD - Environmental Protection - Policy Development - Economic Incentive Options for Green Buildings.

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Sustainable Building programs in the rest of the world

New Zealand, The Green Home Scheme

Developed by the Building Research Association of New Zealand (BRANZ) and designed to help new home builders to create a design that reduces waste of natural resources and energy consumption.

South Africa, The Green Building Project

The Sustainable Building Group of the Facilities Planning and Management of the CSIR, Building and Construction Technology Division (Boutek). This programs works with the private and public sectors in increasing the sustainability of large building through assessments, benchmaking and recognition of good practice.

Kenya, Sustainable construction practices in the Kenyan construction industry

Department of Building Economics and Management Faculty of Architecture, Design and Development University of Nairobi. This project investigated the awareness of and implementation of sustainable construction practices in the Kenyan construction industry.

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Sustainable Building programs in the rest of the world

Argentina

Plan Urbano Ambiental, Government of the City of Buenos Aires.
This program implements the city's Sustainable Building Policy.

Barrios sustentables. Argentinian Governments and private collaborators.
Diverse projects of Sustainable Villages around the country.

Uruguay

Proyecto Horneros, National University of Uruguay, Faculties of Architecture & Agronomy. Sustainable construction of a research building.

Venezuela

Passive systems of cooling application in bioclimatic buildings (ASPE-VB).
Instituto de Investigaciones de la Facultad de Arquitectura y Diseño (IFAD) de la Universidad de Zulia. Computer aided design program.

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Currently offered educational courses

USA

University/College	Title of Educational Course
Howard University	Environmental system I & II
Kansas State University	Design studio project, third year Environmental systems in Architecture, Second year Sustainable Architecture, Four, Five year & Graduate
Miami University of Ohio	ARCH 413/ 414 Some material in ARCH 517/518
Montana State University	No course dealing with environmentally sustainability. Topic mentioned in environmental control courses and design studios
Norwich University	Studio course in Environmental design offered any other year
Oklahoma State University	ARCH 3314: Environmental Control, Life Safety and thermal systems ARCH 5133: Advance Energy Issues in Architecture
University of Detroit – Mercy	ARCH 312: Sustainability and Architecture Seminar
University of Hawaii	ARCH 214: Mechanical systems ARCH 213: Lighting, Illumination, and Power
University of Idaho	ARCH 463/ 462: Environmental Control Systems ARCH 499: Natural Lighting ARCH 499: PSDATE
University of Michigan	ARCH 315/ 425: Core Environmental Technology Courses ARCH 555: Advance Buildings Systems and Operations ARCH 575: Building Ecology ARCH 605: Environmental Design Simulation
University of Tennessee	Required third year courses, ARCH 341/ 342, include sustainability as a component, but not the major focus
University of Utah	ARCH 537, ARCH 635, ARCH 636: Environmental Controls ARCH 670: Financial incentives for Construction ARCH 558: Building rehabilitation and Recycling
University of Waterloo	Environmental and Resource studies 218

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Currently offered educational courses

USA

161 different Universities

564 Institutes / Departments

2,569 different courses

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Currently offered educational courses

Japan

Country	University/College	Title of Educational Course	Degree
Japan	Kyushu Institute of Design	Environmental Systems	B.A. in Environmental Design
Japan	Hachinoche Intitute of Technology	Environmental Design	B.A in Architecture
Japan	School of Engineering – Department of Architecture	Environmental Design	B.A. in Environmental Design
Japan	Mekia University –Faculty of Real Estate Science	Environmental Design	B.A. in Architecture (Wooden Architects) B.A. in Engineering (Building Engineers)
New Zealand	University of Waikato	Interior and Environmental Design	
Australia	University of Tasmania	Building Technology in Design 1 , first year Specialised Studio 1 , second year	Bachelor of Environmental Design
Australia	University of Camberra – Faculty of Environmental Design	002861	Environmental Design Masters Thesis
Australia	University of Western Australia – Faculty of Architecture, Landscape and Visual Arts	http://www.publishing.uwa.edu.au/handbooks/alva/RegsBEnvDes.html	Bachelor of Environmental Design (2512)
Australia	The University of Queensland – Department of Architecture	Environmental design	Master of Philosophy (Architecture)

New Zealand

Australia

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Currently offered educational courses

China

China	The Chinese University of Hong Kong -Architecture	ENV 7003 Topical Study II - Option B: Building Physics and Environmental Design for Sustainability ENV 7004 Topical Study III - Option A: Environmental and Sustainable Design in Practice ENV 7004 Topical Study III - Option B: Green & Sustainable Architectural Design - a perspective (2 units) ENV 7004 Topical Study III - Option C: Life Cycle Costing & Assessment building durability and embody energy (2 units)	Postgraduate Diploma (Sustainable and Environmental Design) and Master of Science (Sustainable and Environmental Design)
China	National Cheng Kung University – Department of Architecture	N75001-2: Architectural and Environmental Design (I)(II)	Master of Science in Architecture PhD in Architecture
China	HKU Space Community College	Environmental Design (first year) Environmental Controls I (second year) Environmental Controls II (third year)	Professional Diploma in Architectural Studies
China	Hartford Institute – Hong Kong		Master of Applied Management

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Currently offered educational courses

Turkey

South & Central America

China	Tongji University School of Environmental Science and Engineering	Environmental Design	Bachelor/Master of Engineering
Turkey	Bilken University	7IIAED	B.A. in Interior Architecture and Environmental Design
Argentina	Universidad Nacional de San Juan – Facultad de Arquitectura		B.A. in Environmental Architecture
Argentina	University of Blas Pascal	Sustainable Architecture and Green Buildings (seminar)	B.A in Architecture
Argentina	Universidad Nacional de la Plata – Facultad de Arquitectura y Urbanismo	Environmental conscious design	Master in Regional Development
Colombia	Universidad La gran Colombia – Facultad de Arquitectura	Design I, III and III Planning	B.A. in Architecture
Costa Rica	University for International Cooperation	Environmental Architecture Environmental Urban Settlement Environmental leadership and Management	Master in Development
Panama	Ciudad del Saber		B.A in Engineering and Environmental Design
Mexico	Instituto Superior de Arte y Diseno	Workshop in Sustainable Architecture	Diploma in Bioclimatic Architecture
Mexico	Universidad Iberoamericana –Puebla	Sustainable Architecture project	Licenciate on Architecture
Mexico	Instituto Tecnologico de Monterrey – Campus Queretaro	AR90-901 Sustainable Architecture	Licenciate in Architecture
Brasil	UFSCAR / UNISANTA	Construção Sustentável e Eco-Eficiência	Curso de Especialização em Engenharia Urbana

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Life Cycle Assessment tools in Building and Construction

LCA software

- LCAid (AUS)
- LISA (AUS)
- BEES (US)

Energy & Building tools

- Athena (CAN)
- BUNYIP (AUS)
- DOE2 (US)
- Optimize (CAN)
- Firstrate (AUS)
- Cheetah (AUS)
- NatHers (AUS)
- DOE-US (200 design tools)

Whole Building Assessment tools

- ECOTECH (AUS)
- Building design advisor 1.0 (US)
- Green building advisor (US)
- LEED (US)
- Firstrate (AUS)
- Cheetah (AUS)
- NatHers (AUS)
- DOE-US (200 design tools)

Task 2. Review of the international state-of-the-art and training actions in Lifetime Environmental Impact Assessment

Malmö declaration, 2000 1st Global Ministerial Environment Forum

Emphasized the importance of the life-cycle economy as the overall objective for the development of cleaner and more resource efficient technologies.

There is evidence that LCA is not being utilized to its full potential, even in those countries that are most involved in its development and application. A major goal is therefore to increase worldwide the availability of information on LCA and to foster its use.

1996, UNEP published *Life Cycle Assessment: What it is and How to do it*.

1999, UNEP published *Towards the Global Use of Life Cycle Assessment*, connected to the workshop held in San Francisco the previous year.

2003, UNEP published *Evaluation of environmental impacts in Life Cycle Assessment*, with the support of the United States Environmental Protection Agency (US-EPA).

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Evaluation of environmental impacts in Life Cycle Assessment

provides a concise overview of the current status of the theory and practice of Life Cycle Impact Assessment (LCIA), document the improvements in the evaluation of impacts in Life Cycle Assessment, and discuss the challenges and opportunities for its wider application.

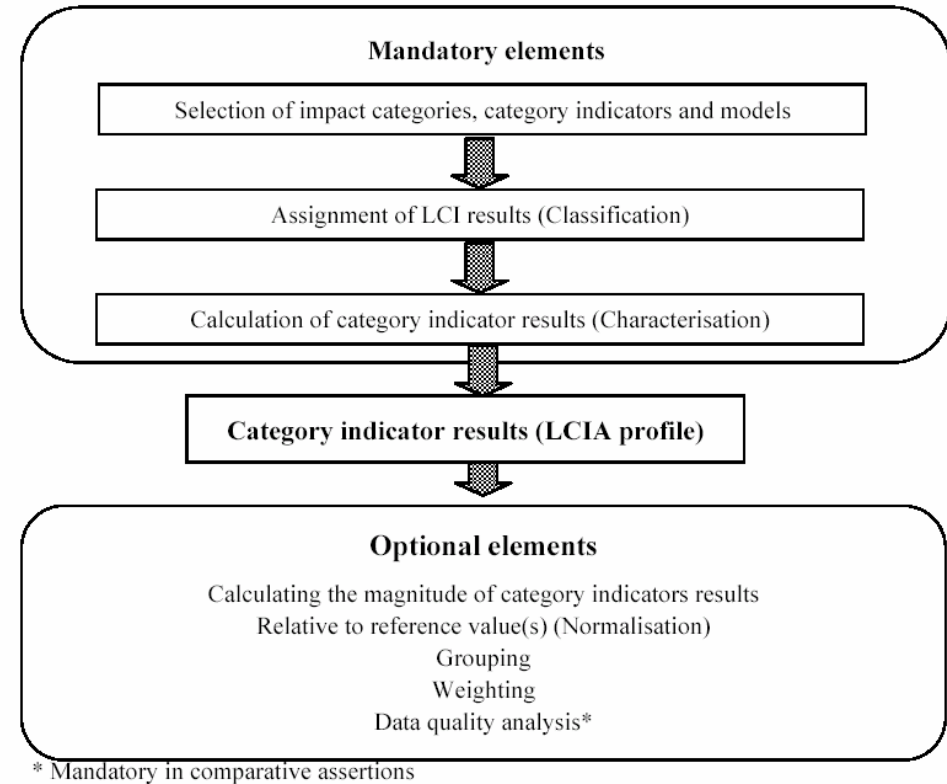
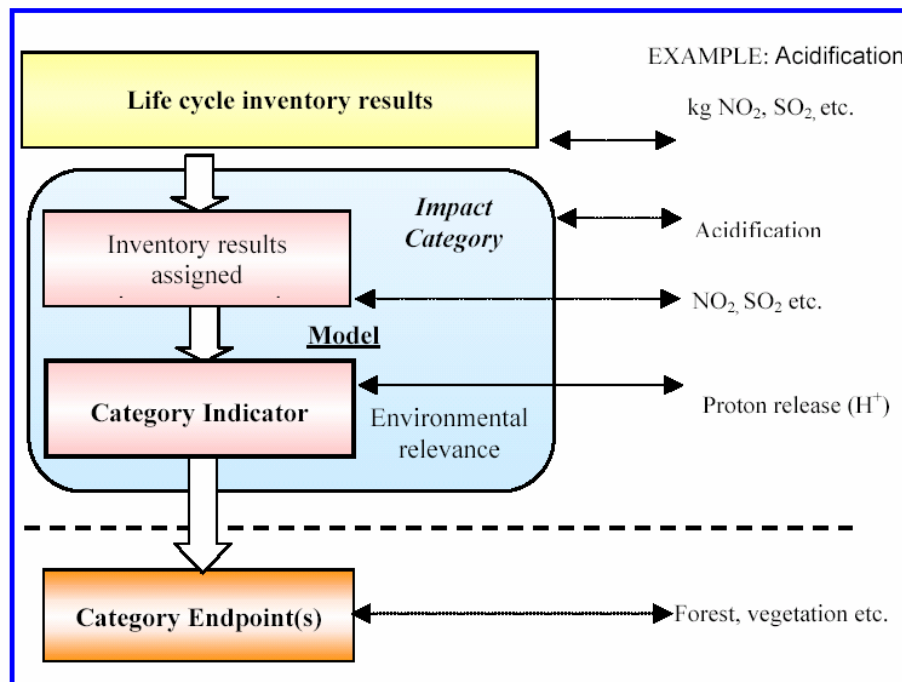
ISO 14042

LCIA provides a framework standardized by ISO 14042 for the systematic evaluation of environmental impacts in LCA.

Several LCIA approaches for different types of environmental impacts have been developed in recent years, including not only the formal step weighting, but the whole topic of assessing environmental stressors in a life cycle perspective.

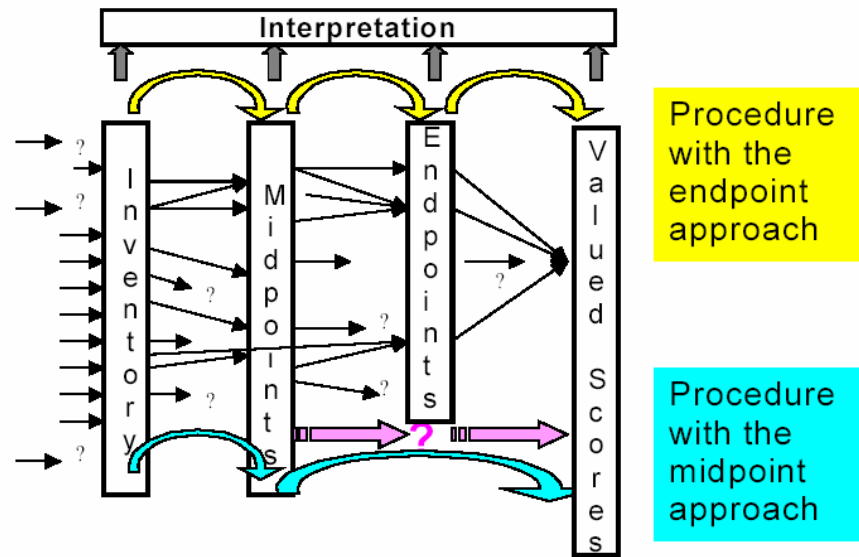
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Mandatory and Optional elements of LCIA according to ISO 14042

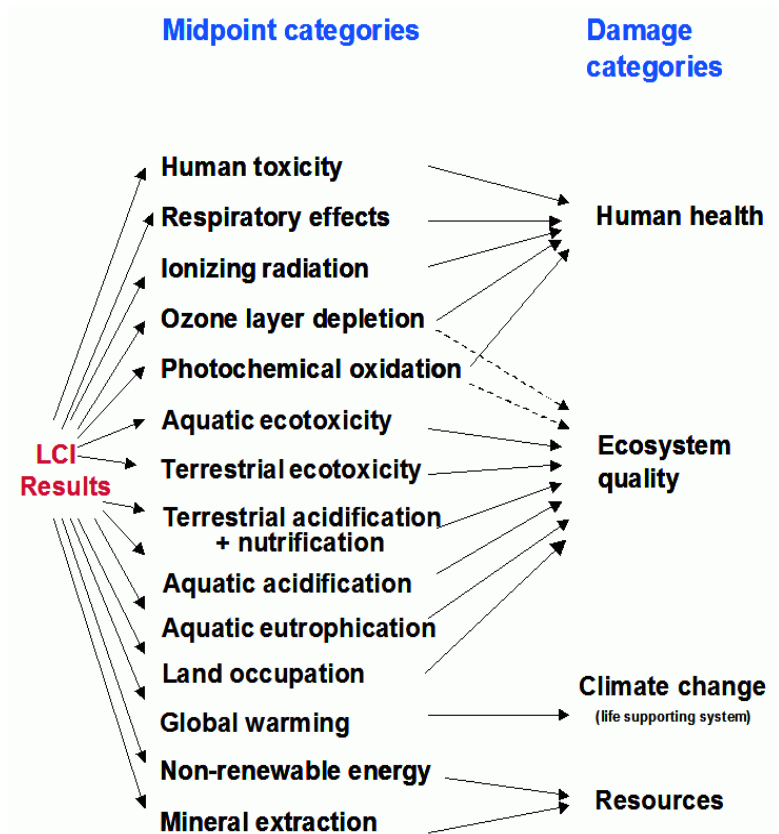
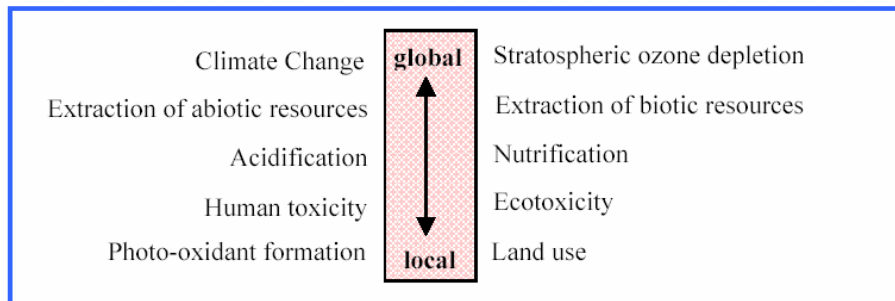


The indicator concept according to ISO 14042

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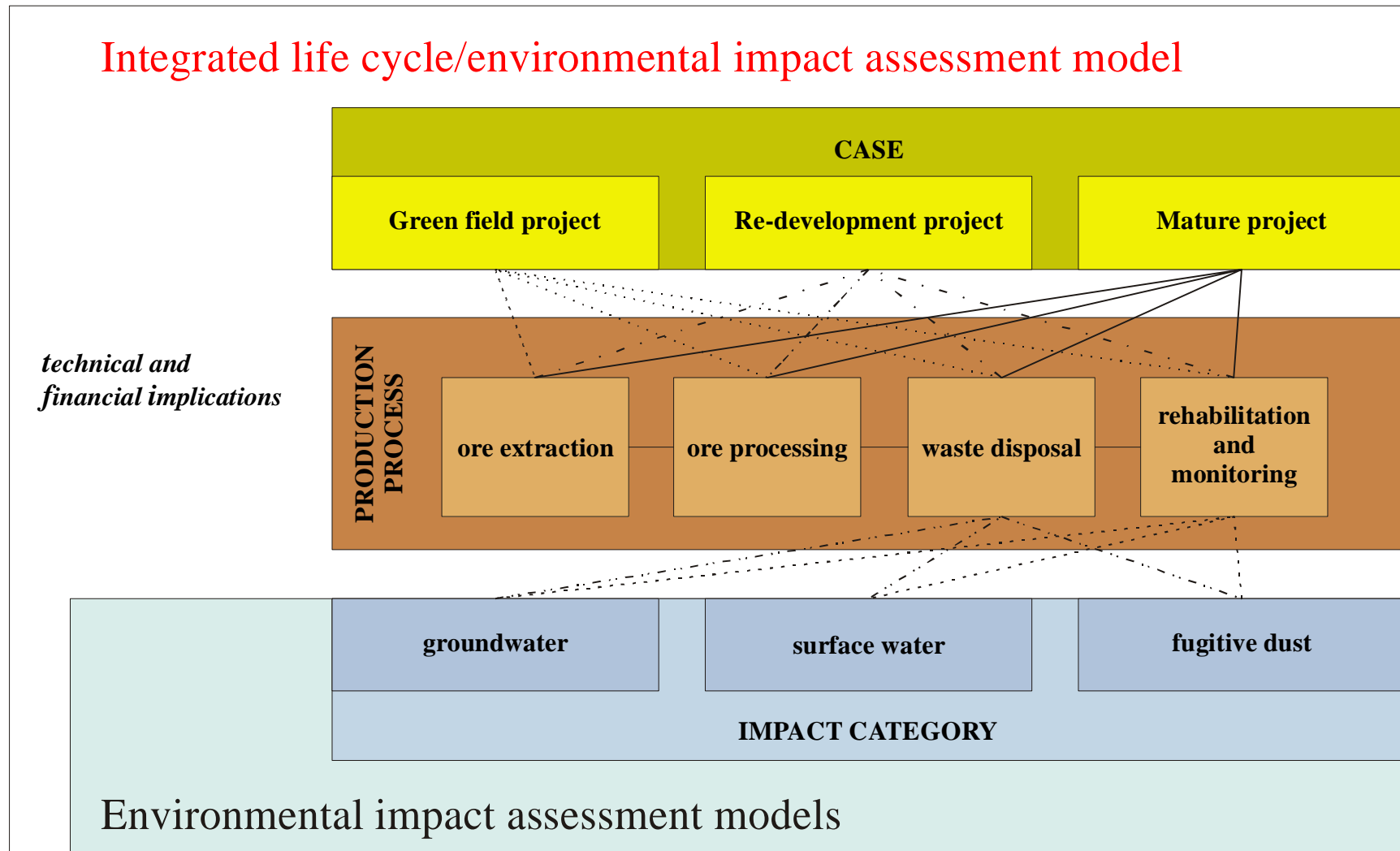


UNEP, 2003



IMPACT2002+, Udo de Haes, et al., CML

Conceptualisation of LCIA Model for Mining Projects



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There have been a number of advances made in the evaluation of environmental impacts in Life Cycle Assessment in recent times:

- The framework for Life Cycle Impact Assessment has become standardized in ISO, enhancing the comparability and avoiding unnecessary variation between studies.
- The fate of substances is increasingly taken into account, in particular using multimedia modelling as a basis for characterization.
- The results of different characterization procedures for the same category are compared among each other and they show convergence.
- Better distinctions are being made between scientific information and value choices.

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Steps forward (UNEP, 2003)

- raising environmental awareness,
- understanding LCA,
- acceptance of LCA,
- and creating incentives.

This implies activities such as

- the launching of communication and education programmes;
- the diffusion of LCA studies and experiences to make decision makers aware of the benefits;
- the involvement of stakeholders in LCA processes to improve their acceptance of the LCA outcome,
- and the procedural incorporation of LCA in policies to stimulate its use in the public arena.

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- **Life Cycle Impact Assessment: Striving towards Best Practice.**
SETAC 2002. ISBN 1-880611-54-6
- **Code of Life-Cycle Inventory Practice** (book and CD)
SETAC 2003. ISBN 1-880611-58-9
- **Life Cycle Assessment in Building and Construction: A State of the Art Report.**
SETAC, 2003. ISBN-1-880611-59-7