UCLouvain

lepl2026

2026

Life cycle assessment as a decision-making tool

2.00 credits	10.0 h + 10.0 h	Q2

Teacher(s)	Bol David ;Luis Alconero Patricia (coordinator) ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Main themes	In this course, we study the principles and application of life cycle assessment (LCA) by engineers, as an essential tool for supporting environmental decision-making in both industrial and strategic contexts. The course is designed to be general in its approach to engineering specializations, enabling the application of these methods to processes, products, and services.
Learning outcomes	**At the end of this learning unit, the student is able to :** • demonstrate their understanding and knowledge of the LCA methodology and associated standards; • understand and interpret the results of an LCA study; • identify the critical steps or elements of a process, product, or service; • use LCA as an eco-design tool; • use LCA in the context of environmental foresight for an entity, industry, or economic sector; • conduct a basic LCA study based on existing data; • explain the advantages and limitations associated with using this methodology. This course will contribute to the development of the following learning outcomes from the Civil Engineering Master's program: • Learning Outcome 1.1. Identify and implement the concepts, laws, and reasoning applicable to a given problem • Learning Outcome 1.2. Identify and use the appropriate modeling and calculation tools to solve this problem • Learning Outcome 1.3. Verify the plausibility and confirm the validity of the results obtained regarding the nature of the problem posed. • Learning Outcome 2.1. Analyze the problem to be solved or the functional need to be met and formulate the corresponding specifications. • Learning Outcome 2.2. Model the problem and design one or more original technical solutions that meet these specifications. • Learning Outcome 2.3. Evaluate and rank the solutions regarding all the criteria listed in the specifications: effectiveness, feasibility, quality, ergonomics, safety, and environmental and societal sustainability. • Learning Outcome 2.4. Implement and test a solution in the form of a mock-up, a prototype, and/or a digital model. • Learning Outcome 2.5. Formulate recommendations to improve the solution studied. • Learning Outcome 5.3. Communicate graphically and schematically; interpret a diagram, present the results of work, and structure information. • Learning Outcome 5.4. Read, analyze, and utilize technical documents (standards, plans, specifications, etc.). • Learning Outcome 5.5. Write documents taking into account contextual requirements and relevant social conventions. • Learning Outcome 6.1. Acquire and use a foundation of knowledge on the issues and tools for multi-criteria assessment of a technology's sustainability, both quantitatively and qualitatively. • Learning Outcome 6.2. Define, specify, and analyze a problem in all its complexity, taking into account its various dimensions (social, ethical, environmental, etc.), scales (time, space), and uncertainty, and identify the spheres of individual and collective responsibility. • Learning Outcome 6.3. Identify, propose, and implement the levers available to engineers that can contribute to sustainable development and technology (eco-design, robustness, circularity, energy efficiency, etc.). • Learning Outcome 6.4. Demonstrate critical thinking regarding a technical solution, understand its limitations, and consider your personal stance in relation to ethical, environmental, and societal issues. • Learning Outcome 6.5. Self-assess your work.
Evaluation methods	• Written exam outside of the scheduled sessions demonstrating the student's ability to conduct a life cycle assessment (LCA) using a rigorous methodology (60% of the grade). • Submission of exercises assigned during practical sessions (40%).
Teaching methods	Presential courses with dynamic sessions on the fundamentals of life cycle assessment and practical computer-based exercises related to this analysis. Specific seminars given by industry professionals/expert consultants may be organized to illustrate the application of life cycle assessment to concrete industrial cases.
Content	This course aims to deepen students' understanding of life cycle assessment (LCA) methodology for evaluating the environmental impact of a process, product, or service. It will show students the key aspects to consider when conducting an LCA and how to interpret the results, enabling them to perform comprehensive and rigorous LCAs

	and propose potential modifications to the process, product, or service that could lead to reduced environmental impacts. The course combines theoretical and dynamic sessions with practical computer-based sessions using a Python-based LCA tool and a leading LCA database in the field. The course is structured as follows: Lectures: • Principles of life cycle thinking and LCA methodology, roles of LCA in decision-making, definition of objectives and scope of study (definition of the functional unit, determination of reference flows, selection of boundaries, end-of-life modeling, attributional and consequential approaches, multifunctionality and allocation), and mathematical formulation of LCA. • Life cycle inventory (data sources, classification, tool and database selection). • Impact assessment (DPSIR framework and environmental mechanisms, characterization, normalization, and weighting). • Interpretation of results (sensitivity and uncertainty analysis based on parametric LCA, hotspot detection, communication). • Advanced concepts (prospective LCA, consequential LCA, absolute impact analysis with respect to planetary boundaries, social LCA, techno-economic analysis and LCA, application of LCA in industry). Practical exercises: • Construction of a simple LCA according to ISO 14040 • Functional unit and reference flow, multifunctionality, allocation • Impact categories and units • Sensitivity analysis to modeling assumptions, comparison of LCA results • Parametric modeling and uncertainty analysis • Dynamic and prospective modeling
Inline resources	All necessary resources will be provided via Moodle.
Faculty or entity in charge	EPL

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Chemical and Materials Engineering	KIMA2M	2		
Master [120] in Civil Engineering	GCE2M	2		
Master [120] in Electrical Engineering	ELEC2M	2		
Master [120] in Chemistry and Bioindustries	BIRC2M	2		