Linnæus University

Dnr: LNU-2023/646

Course syllabus

Faculty of Technology

Department of Built Environment and Energy Technology

4BT312 Livscykelanalys (LCA), 7,5 högskolepoäng
4BT312 Life Cycle Analysis (LCA), 7.5 credits

Main field of study
Civil Engineering, Energy Technology, Environmental Engineering

Subject Group
Building Technology

Level of classification
Second Level

Progression
A1N

Date of Ratification
Approved 2017-05-29
Revised 2023-03-13 by Faculty of Technology. Prerequisites are revised.
The course syllabus is valid from spring semester 2024

Prerequisites
Bachelor's degree in technical subjects or a Bachelor's degree in Engineering (Technology) or equivalent.
English 6 or equivalent.

Objectives
On completion of the course the student is expected to be able to:

- Characterize and reflect on requirements, standards as well as guidelines for LCA of products and service systems
- Reflect on influences of methodological choices on LCA results and be able to critically evaluate implications of LCA modelling decisions
- Analyse, interpret and validate LCA of a product or a service system by applying appropriate methods and tools to overcome modelling challenges.

Content
In this course, students will be trained to undertake LCA for different products and service systems considering natural resource use and environmental impacts along the entire life cycle chain, from raw material extraction to end-of-life management. Students will acquire in-depth knowledge on standards, concepts and methodological

issues as well as tools for undertaking a complete LCA. The course will explore approaches in LCA and give overview of principles for holistic life cycle modelling of environmental impacts of products and systems. Key challenges in modelling life cycle impacts of bio-based systems will be discussed. Specifically, the themes explored include:

- Overviews of sustainability imperatives and life cycle thinking
- LCA motivations, standards, databases and off-the-shelf software
- Fundamentals of energy and mass flows
- LCA - goal definition, functional units, system boundaries and allocation
- LCA - methods for compiling inventory data
- LCA - impact assessment methods and categories
- LCA - results reporting and interpretation
- Building spreadsheet-based LCA models
- Methodological challenges and approaches in modelling life cycle implications of wood and non-wood product systems

Type of Instruction

The teaching consists of lectures, seminars, exercises and a project work. Exercises and project work are mandatory.

Examination

The course is assessed with the grades A, B, C, D, E, Fx or F.

The grade A constitutes the highest grade on the scale and the remaining grades follow in descending order where the grade E is the lowest grade on the scale that will result in a pass. The grade F means that the student’s performance is assessed as fail (i.e. received the grade F).

The course contains of written exams and project work.

The final grade is a weighted average of assessment methods.

Repeat examination is offered in accordance with Local regulations for courses and examination at the first and second-cycle level at Linnaeus University.
If the university has decided that a student is entitled to special pedagogical support due to a disability, the examiner has the right to give a customised exam or to have the student conduct the exam in an alternative way.

Course Evaluation

During the implementation of the course or in close conjunction with the course, a course evaluation is to be carried out. Results and analysis of the course evaluation are to be promptly presented as feedback to the students who have completed the course. Students who participate during the next course instance receive feedback at the start of the course. The course evaluation is to be carried out anonymously.

Other

Grade criteria for the A–F scale are communicated to the student through a special document. The student is to be informed about the grade criteria for the course by the start of the course at the latest.

Students should be used to working with Microsoft Excel.

Required Reading and Additional Study Material

Required reading

• ISO 14040. 2006. Environmental management - Life cycle assessment -Principles and framework. Geneva: International Organization for Standardization. Number of pages: 20.

• ISO 14044. 2006. Environmental management - Life cycle assessment-Requirements and guidelines. Geneva: International Organization for Standardization. Number of pages: 46.

• ISO/TS 14067:2013. Greenhouse gases - Carbon footprint of products -Requirements and guidelines for quantification and communication. Geneva: International Organization for Standardization. Number of pages: 52.

• Christiansen, Kim, Hoffman, Leif, Virtanen, Yrjö, Juntilla, Vesa, Rønning, Anne, Ekvall, Tomas, and Finnveden, Göran. (1995). Nordic guidelines on life-cycle assessment. Nordic Council of Ministers. Number of pages: 222.

• Cardenas, I. C., and Halman, J. I. (2016). Coping with uncertainty in environmental impact assessments: Open techniques. Environmental Impact Assessment Review, 60, 24-39.

• Bengtsson, M., & Steen, B. (2000). Weighting in LCA–approaches and applications. Environmental progress, 19(2), 101-109.

• Dodoo, A., Gustavsson, L., Sathre, R. (2014). Lifecycle carbon implications of conventional and low-energy multi-storey timber building systems. Energy & Buildings. 82. 194-210.

• Lippke, B., Oneil, E., Harrison, R., Skog, K., Gustavsson, L. and Sathre, R. (2011) Life cycle impacts of forest management and wood utilization on carbon mitigation: knowns and unknowns. Carbon Management, vol. 2: 3, pp. 303-333.

• Mason E.J. and Halog A. (2011) Consequential life cycle assessment: a review. International Journal of Life Cycle Assessment. 16(5): 445-453

• Guinee, J., Heijungs, R., Huppes, G., Zamagni, A., Masoni, P., Buonamici, R., Ekvall, T., Rydberg, T. Life cycle assessment: Past, present, and future. Environ. Sci. Technol. (2010) 45, 90-96.

• Finnveden, G. (2000). On the Limitation of Life Cycle Assessment and Environmental Systems Analysis Tools in General. International Journal of Life Cycle Assessment 5(4): 229-238.

• Ekvall T, Weidema B. (2004) System Boundaries and Input Data in Consequential Life Cycle Inventory Analysis. International Journal of Life Cycle Assessment 9 (3)161–171

• Azapagic, A. and R. Clift (1999). Allocation of Environmental Burdens in Co-product Systems: Product-related Burdens (Part 1). International Journal of Life Cycle Assessment 4(6): 357-369.

• Pesonen, H.-L., T. Ekvall, et al. (2000). Framework for Scenario Development in

LCA. International Journal of Life Cycle Assessment 5(1): 21-30.

• Jönsson, Å., Tillman, A-M.and Svensson, T. (1997) Life cycle assessment of flooring materials: Case-study. Building and Environment, 32(3): 245-255.

• Werner, F. and Richter, K. (2007) Wooden building products in comparative LCA: A literature review. International Journal of Life Cycle Assessment, 12(7): 470-479.

Current articles and other relevant material.