Linnæus University

Dr: 2022/2106-3.1.2.2

Course syllabus

Faculty of Technology

Department of Building Technology

4BY369 Energi och klimateffektivt byggande, 7.5 credits
Energy and climate efficient construction

Main field of study
Civil Engineering

Subject Group
Building Technology

Level of classification
Second Level

Progression
A1F

Date of Ratification
Approved 2019-06-10
Revised 2022-05-16 by Faculty of Technology. Examination and literature list are revised.
The course syllabus is valid from spring semester 2023

Prerequisites
Basic eligibility for advanced level studies and special eligibility: 90 credits in the field of building technology, civil engineering, mechanical engineering or equivalent; English B / English 6 or equivalent.

Objectives

Knowledge and understanding
To pass, the student is expected to:

- Have advanced knowledge of sustainability concepts and related challenges in the built environment.
- Have a comprehensive understanding of energy and environmental implications of building materials in a life cycle perspective.
- Be able to describe and interpret concepts relevant to energy and material flow analyses.
- Have in-depth knowledge of life cycle assessment as a tool for design of energy and climate-efficient sustainable buildings.
- Have deep insight into methodological issues in the analysis energy and carbon balances over a building’s life cycle.

Competence and Skills
To pass, the student is expected to:

- Be able to apply relevant sustainability standards and methodological approaches for assessment of environmental performance of building elements and structures.
- Be able to develop spreadsheet-based models for life cycle inventory analysis of energy and carbon flows in the production stage of structures and buildings.
- Be able to determine and select environmentally preferable structural engineering and construction solutions based on sustainability assessment and life cycle analysis.
- Be able to critically evaluate the influences of methodological choices and data sources for environmental analysis on the results of life cycle analysis.

Judgement and approach
To pass, the student is expected to:

- Be able to judge how assumptions, data choice and methodological approach affect the results of a life cycle analysis
- Be able to judge appropriate approaches for analysis of environmental sustainability of construction materials and works in various contexts

Content

Concerns about energy and environmental impacts of the built environment have increased focus on the choice of building and construction materials. Engineers can take various steps to mitigate the environmental impact of buildings through considerations of design and deployment of materials in construction. This course gives understanding of methods and tools to improve resource efficiency and minimize environmental impacts of buildings. It explores the implications of the choice of construction material for energy-efficient and sustainable building design. In this course, students will learn about material and energy flow analyses, and how to conduct sustainability assessment as well as life cycle analysis for building elements and construction systems. Themes explored in the course include:

- Building and construction-related sustainability issues
- Energy and environmental implications of key materials for building production (e.g. concrete, insulation, metals and wood)
- Effect of the choice of building structural system and material (cross laminated timber, light timber, reinforced concrete, steel, etc.) on environmental impact of buildings in a life cycle perspective
- Fundamentals of energy and mass flows in the construction industry
- Life cycle thinking and sustainability assessment standards as well as evaluation tools
- Life cycle analysis methods commonly used within the building construction sector
- Application and development of spreadsheet models for life cycle analysis of building components and structures
- Methodological challenges and approaches in assessment of environmental performance of buildings in a life cycle perspective
- Environmental performance of in-situ and prefabricated structures
- Energy and environmental impacts of construction materials transportation
- Implications of service life and end-of-life options for environmental performance of construction materials and buildings

Type of Instruction
The teaching consists of lectures, seminars, exercises and a project work. Exercises and the 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 examination is divided into the following

- Written exam A-F 4,5
- Assignments A-F 3

The course is examined through individual written examination and assignments. The written examination steer the final grade and both the written examination and assignments must be passed.

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.

The course materials can be accessed at the course online platform and the literature list can be supplemented with other relevant articles and materials. Students should be familiar with the use of Microsoft Excel.

Required Reading and Additional Study Material
Required reading

- Course compendium, Energy efficient and sustainable construction, Dodoo, A. (2019), 106 pages. The material is provided by the Department of Building Technology, Linnaeus University.
- Goodhew, S. (2016). Sustainable construction processes: A resource text. John Wiley & Sons. Number of pages: 342
- Berge, B. (2009). The ecology of building materials. 2nd Edition, Routledge.

Number of pages: 448

Reference literature

- BS EN 15978:2011 Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method.
- Dodoo, A., Gustavsson, L., Sathre, R. (2015). Climate impacts of wood vs. non-wood buildings. Final report for Sveriges Kommuner och Landsting, Number of pages: 55.
- 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.
- 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.
- Finnveden, G.; Hauschild, M. Z.; Ekvall, T.; Guinée, J.; Heijungs, R.; Hellweg, S.; Koehler, A.; Pennington, D.; Suh, S. (2009). Recent developments in life cycle assessment. Journal of Environmental Management, 91, pp. 1–21.
- 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.