



Faculty of Health, Science and Technology
Environmental and Energy Systems

Syllabus

Forest bioeconomy - processes, energy and products

Course Code:	EMAD35
Course Title:	Forest bioeconomy - processes, energy and products <i>Skoglig bioekonomi - processer, energi och produkter</i>
Credits:	15
Degree Level:	Master's level
Progressive Specialisation:	Second cycle, has only first-cycle course/s as entry requirements (A1N)

Major Field of Study:

KTA (Chemical Engineering)
MEI (Environmental and Energy Systems)

Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2026-01-29, and is valid from the Autumn semester 2026 at Karlstad University.

Prerequisites

Registered for 180 credits in the Master of Science Programme in Energy and Environmental Engineering, Chemical Engineering, or Industrial Management. Pass grade in the courses Sustainable development (7.5 credits) and Thermal fluid sciences (7.5 credits).

In addition, upper secondary level Swedish 3 or Swedish as a second language 3, and English 6, or Swedish level 3 or Swedish as a second language level 3, and English level 2.

An equivalence assessment can be made.

Learning Outcomes

The aim of the course is for students to acquire in-depth knowledge of the structure of biomass, bioenergy, and existing and emergent forest industry processes.

Upon completion of the course, students should be able to

- explain the concept of bioeconomy and elaborate on different perspectives on the forest as an ecosystem and a resource,
- elaborate on sustainability aspects of industrial processes for biomass from a life cycle perspective,
- give an account of the structure of wood in terms of its macro-molecular components,
- explain and give examples of bioindustrial processes, and
- give an account of and explain selected unit operations within the area of bioindustrial processes.

Content

The course comprises the following components:

- The concepts of bioeconomy and circularity
- The forest as a provider of ecosystem services, including biomass
- Forest biodiversity
- Foundations of environmental ethics
- Policy instruments in bioeconomy
- Forestry and harvesting techniques
- Resource management in industrial processes
- The development of biomass from an evolutionary perspective
- Wood and fibre morphology
- The chemical structure of biomass

- The environmental impact of forest industry processes
- Conflicts of interest in sustainable land use

The course provides knowledge of the following processes:

- Sawmilling
- Wooden construction
- Mechanical and chemical pulp production
- Paper production technology
- Solid biofuels
- Biorefineries
- New materials and processes
- Selected unit operations in bioindustrial processes, such as drying, pelleting, and extrusion

The course consists of a series of lectures, a literature seminar, a study visit, a simulation exercise, and a laboratory project in which students work in pairs, or, occasionally, individually or in groups of three. Students plan, conduct, and evaluate an experiment in bioenergy or purification technology that addresses a research question, according to instructions. This involves analysis of results and presentation of findings with visual aids (such as diagrams, graphs, and images) to support and enhance their presentation.

Reading List

See separate document.

Examination

Assessment is based on:

- Active participation in seminar (1.5 cr)
- Active participation in a simulation exercise (1.5 cr)
- An individual on-campus written exam (7.5 cr)
- Written and oral project presentations (4.5 cr)

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

Grades

One of the grades Pass with Distinction (VG), Pass (G), or Fail (U) is awarded in the examination of the course. Engineering students are awarded one of the grades Pass with Distinction (5), Pass with Some Distinction (4), Pass (3), or Fail (U).

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional information

The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.