Reg No: EMG212/20252

Faculty of Health, Science and Technology
Environmental and Energy Systems

Syllabus

Sustainable energy system project

Course Code:	EMG212
Course Title:	Sustainable energy system project *Hållbart energisystemsprojekt*
Credits:	15
Degree Level:	Undergraduate level
Progressive Specialisation:	First cycle, has less than 60 credits in first-cycle course/s as entry requirements (G1F)

Major Field of Study:
MEI (Environmental and Energy Systems)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2025-02-20, and is valid from the Autumn semester 2025 at Karlstad University.

Prerequisites
Registered for 60 ECTS credits in the Bachelor programme in Energy and Environmental Engineering, with at least 15 ECTS credits completed, or equivalent

Learning Outcomes
The aim of the course is for students to develop and enhance key fundamental knowledge of applied thermodynamics, fluid mechanics, and heat and mass transfer, broaden and deepen their knowledge of concepts and facts, and be familiar with using standard problem-solving methods and systems analysis for energy engineering systems and energy for sustainable development.

Knowledge and understanding
Upon completion of the course, students should be able to:

- describe the function of energy engineering systems and their components such as compressors, turbines, heat exchangers, steam boilers, coolers, etc and relevant accessories,
- give an account of the importance of the isentropic effect in thermodynamic processes and cycles,
- give an account of the production and distribution of bioenergy,
- describe how the design and construction of combustion plants affect the emission of environmentally harmful substances, and
- describe how district heating nets and the distribution of heat can be adjusted to varying needs of effects.

Competence and skills
Upon completion of the course, students should be able to:
- analyse and assess thermodynamic cycle processes such as gas and steam cycles, cooling cycles, and Carnot cycles,
- apply knowledge of heat and fluid engineering in dimensioning the components of energy engineering systems,
- interpret and use Fourier's heat conduction equation,
- calculate basic combustion and gasification processes,
- interpret and describe energy engineering systems using a process model, and
- demonstrate skills in presenting project results according to a scientific format, orally and in writing.

Judgement and approach
Upon completion of the course, students should be able to:
- assess energy efficient projects in terms of thermodynamic limitations and sustainability principles,
- create system solutions and perform system analysis for sustainable energy engineering systems,
- estimate the total thermal efficiency of energy sources, and
- give arguments for the choice of component such as pumps, compressors, and heat exchangers in energy engineering systems.

Content
Students work individually and in groups on project tasks and present them orally and in writing.

The course covers the following:
- one-dimensional stationary heat transfer
- transient heat transfer
- two-dimensional stationary heat transfer
- dimensionless numbers
- heat exchanger
- cooling tower
- cooling machines
- ideal and real gases
- gas transformation
- gas and steam cycles
- cooling cycles
- combustion calculations
- report writing
- Excel-based calculations

Reading List
See separate document.

Examination
Assessment is based on oral and written presentations of project tasks, completed individually and in groups.

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 Distinction (VG), Pass (G), or Fail (U) is awarded in the examination of the course.

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.