



# Programme Syllabus

Bachelor of Science in Energy and Environmental Engineering

<b>Programme code:</b>	TGHEM
<b>Programme title:</b>	Bachelor of Science in Energy and Environmental Engineering <i>Högskoleingenjörsprogrammet i energi- och miljöteknik</i>
<b>Credits:</b>	180
<b>Programme approval:</b>	The programme syllabus was approved by the Faculty Board of Health, Science and Technology on 12 September 2024, effective from the spring semester 2025.
<b>Language of instruction:</b>	Swedish and English
<b>Education cycle:</b>	First (Bachelor's level)
<b>Degree type:</b>	Professional
<b>Degree title:</b>	Bachelor of Science in Energy and Environmental Engineering
<b>Entry requirements:</b>	General entry requirements and Physics 2, Chemistry 1, Mathematics 3c/Mathematics D

## General information

The programme leads to a Degree of Bachelor of Science in Energy and Environmental Engineering. The aim of the programme is to provide students with the opportunity to acquire sound knowledge and understanding of issues related to energy engineering and sustainable development. Central issues concern environmental engineering, energy processes, fluid mechanics, and heat and mass transfer. A common thread throughout the programme is the development of students' ability to analyse and comprehend connections and to view issues from various perspectives. Graduates in energy and environmental engineering from Karlstad University will acquire modern and advanced knowledge of installation technology, purification technology, bioenergy technology as well as design,

construction and analysis of energy systems. The need for a transition from fossil-based energy systems to more renewable systems requires educated professionals with relevant expertise and analytical minds, open to innovation and change. These are qualities that we focus on throughout the programme.

Systems analysis is a highly useful tool for understanding complex contexts and can be used as a method in connection with design work, investigations, or exploratory development work. In the programme, the use of systems analysis extends from pure design work where students get to apply their subject knowledge, to investigative questions with a focus on societal needs. By analysing a change beforehand, unpleasant surprises can be avoided, such as financial costs or environmental impacts.

The programme provides insight into the engineer's role in societal development, both socially and economically, and prepares students to be open to change, work responsibly and show respect in their future profession. Students gain the knowledge and skills required to be both nationally and internationally competitive. The programme also allows students to acquire sound knowledge of basic natural sciences and engineering as well as mathematics. Overall, the programme provides students with a broad and flexible set of skills that are attractive in the labour market. Upon successful completion of the programme, students shall have acquired the prerequisites to work as a professional engineer, follow the development in the field of engineering as well as having acquired a foundation for life-long learning.

### **Programme outcomes**

The Higher Education Ordinance, System of Qualifications, specifies the outcomes required for certain degrees. The outcomes for a Degree of Bachelor of Science in Engineering are as follows:

- **General outcomes**  
For a Degree of Bachelor of Science in Engineering the student shall demonstrate the knowledge and skills required to work autonomously as a graduate engineer.
- **Knowledge and understanding**  
For a Degree of Bachelor of Science in Engineering the student shall
  - demonstrate knowledge of the disciplinary foundation of the engineering field chosen and proven experience in this field as well as awareness of current research and development work, and
  - demonstrate broad knowledge in the engineering field chosen and relevant knowledge of mathematics and the natural sciences.
- **Competence and skills**  
For a Degree of Bachelor of Science in Engineering the student shall
  - demonstrate the ability to identify, formulate and deal with issues autonomously and creatively using a holistic approach and to analyse and evaluate technological solutions
  - demonstrate the ability to plan and using appropriate methods undertake tasks within predetermined parameters
  - demonstrate the ability to use knowledge critically and systematically to model, simulate, predict and evaluate series of events on the basis of relevant information
  - demonstrate the ability to design and manage products, processes and systems while taking into account the circumstances and needs of individuals and the targets for economically, socially and ecologically sustainable development set by the community
  - demonstrate the capacity for teamwork and collaboration with various constellations, and

- demonstrate the ability to present and discuss information, problems and solutions in speech and writing and in dialogue with different audiences.
- Judgement and approach  
For a Degree of Bachelor of Science in Engineering the student shall
  - demonstrate the ability to make assessments informed by relevant disciplinary, social and ethical aspects
  - demonstrate insight into the possibilities and limitations of technology, its role in society and the responsibility of the individual for how it is used, including social and economic aspects as well as environmental and occupational health and safety aspects, and
  - demonstrate the ability to identify the need for further knowledge and undertake ongoing development of his or her skills.
- Independent project (degree project)  
For a Degree of Bachelor of Science in Engineering the student shall
  - within the parameters of course requirements complete an independent project (degree project) of at least 15 credits.

In addition to the learning outcomes specified in the System of Qualifications outlined in the Higher Education Ordinance (SFS 2006:1053) and the regulations of Karlstad University, the student shall meet the following outcomes for a Degree of Bachelor of Science in Energy and Environmental Engineering:

- Knowledge and understanding
  - demonstrate specialised knowledge of systems analysis and its applications in energy and environmental engineering
  - demonstrate specialised knowledge of the conditions for social, economic and environmental sustainability and demonstrate knowledge of sustainable engineering.
- Competence and skills
  - be able to describe some of the most common energy and purification systems at system and component level
  - autonomously formulate energy and mass balances for the most common energy and purification systems
  - be able to perform design calculations for parts of the most common energy and purification systems.
- Judgement and approach
  - be able to analyse how a change at the component level in the most common energy and purification systems affects the function and energy efficiency of the systems
  - be able to autonomously analyse and evaluate the environmental impact of energy and purification systems from a life span perspective.

### **Programme structure**

The first year of the programme comprises basic and introductory courses in engineering, as well as courses in natural sciences and mathematics. A strong emphasis is placed on student-centered activities, starting from a problem-focused perspective. In the second year, students take courses to acquire knowledge about various energy and purification systems, as well as theoretical and analytical knowledge to create models of these systems in stationary states. The third year comprises courses where the students learn how to develop and analyse the energy and purification systems in different ways. The final semester includes an optional

course, after which the programme concludes with a degree project which can be written in collaboration with a company, public agency, etc., in Sweden or abroad.

#### Internationalisation

Karlstad University wants to promote collaboration and exchange with other universities. In line with this, Karlstad University has partnerships with many other universities in Sweden and abroad, as well as an organisation in place to support students who want to make use of this opportunity. Students are therefore encouraged to complete part of the programme at a university abroad.

Students enrolled in the programme are offered the opportunity to go on an exchange during semester 3<sup>a</sup> or semester 5. Students are also encouraged to place their degree project abroad, for example, in a developing country.

*<sup>a</sup> semester 4 for students admitted in the spring*

### **Programme curriculum<sup>1</sup>**

#### **Mandatory courses**

Sustainable development and environmental engineering, 30 credits

Mathematics for engineers, 15 credits

Basic thermodynamics, fluid mechanics, and heat and mass transfer, 30 credits

Applied energy and environmental engineering, including Installation technology,

Sustainable energy and electricity systems, and Energy and environmental systems analysis,  
75 credits

Degree project, at least 15 credits<sup>2</sup>

#### **Optional courses**

0 - 15 credits<sup>2, 3</sup>

<sup>1</sup> *Subject areas are indicated here. Course included in the programme may have different titles.*

<sup>2</sup> *Students have the option of writing a degree project of 15, 22.5 or 30 credits. 22.5 credits is standard, degree projects of 15 credits are for students who are enrolling in further studies in Energy and Environmental Engineering, and 30-credit degree projects are for students completing an international degree project.*

<sup>3</sup> *0 – 22.5 credits for students admitted to the programme in the spring*

#### **Credit transfer**

Students have the right to transfer credits from previously completed university courses in Sweden or abroad. Credit transfer is subject to approval according to the current regulations.

#### **Additional information**

The local regulations for first and second cycle education at Karlstad University stipulate the obligations and rights of students and staff.

This programme syllabus will replace the previous version approved 1 December 2022 (HNT 2022/658).