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Faculty of Health, Science and Technology

## Programme Study Plan

### 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
<b>ECTS credits:</b>	180 ECTS cr.
<b>Programme Approval:</b>	The Programme Study Plan was approved by the Faculty Board of Health, Science and Technology on 9 December 2016 and is effective from the autumn semester of 2017.
<b>Language of Instruction:</b>	Swedish and English
<b>Degree Level:</b>	Bachelor's
<b>Degree Type:</b>	Professional Degree
<b>Prerequisites:</b>	General entry requirements plus either: – field-specific eligibility 8 (Mathematics D, Physics B and Chemistry A) or – field-specific eligibility A8 (Mathematics 3c, Physics 2 and Chemistry 1)  Students starting in the spring term start with a preparatory semester to fulfil the entry requirements and join the programme the following autumn.

#### General Information

The programme leads to a Bachelor of Science in Energy and Environmental Engineering. The aim is develop students' knowledge and understanding of issues connected to energy engineering and sustainable development. Central questions involve environmental engineering, energy processes, fluid sciences, as well as heat and mass transfer. A common thread throughout the programme is developing students' capacity to analyse and understand contexts, as well as their ability to approach issues from different angles. A Karlstad University graduate in Energy and Environmental Engineering has advanced modern knowledge of building services engineering, cleaning technology and bioenergy technology as well as of the

design, construction and analysis of energy systems. To convert the world's fossil-based energy systems to renewable energy systems, people with knowledge of energy and the environment, the ability to think analytically and with a willingness to change are in great demand and the programme focuses on developing exactly these skills.

System analysis is a very useful tool in understanding complex contexts and may also be used as a method in connection with construction work, investigations or exploratory development. In the programme, system analysis is employed areas as diverse as pure construction work, giving students opportunity to apply their subject knowledge, and investigative work focusing on community needs. Unpleasant surprises, such as financial costs or environmental impact, can be avoided if change is analysed in advance.

The programme leads to insight into the role played by engineers in economic and social aspects of societal development, and prepares students to be willing to change, take responsibility and show respect. The programme provides knowledge and skills that are nationally in demand and internationally competitive. The programme further provides a good foundation in natural sciences and technology as well as in mathematics. On the whole, the programme gives students broad, flexible competences that are attractive on the labour market.

### **Aims**

Upon completion of the programme students should be able to work as engineers, follow technological developments and have a foundation for lifelong learning.

Students completing a Bachelor of Science in Engineering at Karlstad University should meet the requirements specified in the Higher Education Ordinance (SFS 2006:1053), namely:

- **Overarching outcome**  
For a Degree of Bachelor of Science in Engineering, student should demonstrate the knowledge and skills required to work independently as graduate engineers.
- **Knowledge and understanding**  
For a Degree of Bachelor of Science in Engineering students should:
  - 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 students should:
  - demonstrate the ability to identify, formulate and deal with issues independently 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 students should:
  - 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 their skills.
- Independent project (degree project)  
A requirement for the award of a Degree of Bachelor of Science in Engineering is completion of an independent project (degree project) of at least 15 ECTS credits.

In addition to the requirements specified in the Higher Education Ordinance (SFS 2006:1053) and in Karlstad University's regulations, students completing a Bachelor of Science in Energy and Environmental Engineering should meet the following requirements:

- Knowledge and understanding  
For a Degree of Bachelor of Science in Engineering students should:
  - demonstrate in-depth knowledge of system analysis and its application in energy and environmental engineering, and
  - demonstrate in-depth knowledge of the prerequisites for economic, social and ecologically sustainable development, and demonstrate knowledge of sustainable application of technology.
- Competence and skills  
For a Degree of Bachelor of Science in Engineering students should:
  - be able to describe some of the most common energy and cleaning systems at systemic and component levels,
  - be able to formulate energy and mass balances independently for the most common energy and cleaning systems, and
  - be able to complete construction calculations for components of the most common energy and cleaning systems.
- Judgement and approach  
For a Degree of Bachelor of Science in Engineering students should:
  - be able to analyse how a change at component level in the most common energy and cleaning systems influence the system's functionality and energy efficiency, and
  - be able to analyse and evaluate the environmental impact of energy and cleaning systems independently and from a lifecycle perspective.

### **Programme Structure**

The first year comprises basic and introductory courses in engineering as well as natural sciences and mathematics. In the second year the focus is on courses providing knowledge of energy and cleaning systems as well as theoretical and analytical knowledge of the modelling of these systems in stationary condition. The third-year courses provide opportunities to develop and analyse energy and environmental systems. The last semester includes an optional course and the programme concludes with a degree project, preferably completed in conjunction with industry, government agencies, etc. in Sweden or abroad.

### **Internationalisation**

Karlstad University wants to promote cooperation and exchange with other universities. Karlstad University collaborates with many other universities in Sweden and abroad, and encourages students to make the most of such opportunities. Programme students who want to complete some of their courses at foreign institutions, including their degree projects, are therefore supported.

### **Programme Curriculum**

Energy and environmental engineering, including, for instance, thermal and fluid sciences, fluid mechanics, thermodynamics, industrial energy engineering, building services engineering,

cleaning technologies, environmental analysis, as well as natural science (135 ECTS cr.), mathematics (15 ECTS cr.), optional courses (15 ECTS cr.) and a degree project (at least 15 ECTS cr.).

### **Degree Awarded**

Upon fulfilment of all degree requirements students may request a degree certificate from the university's Degree Office.

Degree awarded:

Bachelor of Science in Energy and Environmental Engineering

### **Transfer of Credits**

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

### **Additional Information**

In the Bachelor of Science in Engineering programmes the following grading scale is generally used: fail (U), three (3), four (4) or five (5). Other grading scales may be used in some courses, as indicated in the course syllabi.

Students have to complete the required number of programme credits before they can start their degree projects, which should be the final course taken in the programme. The number of credits required is stipulated in the syllabi concerned.

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